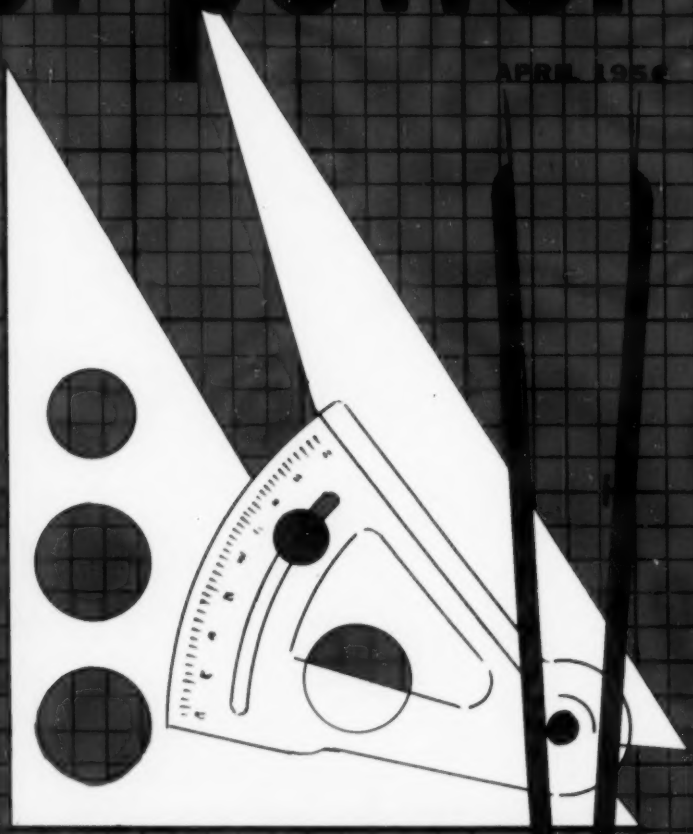
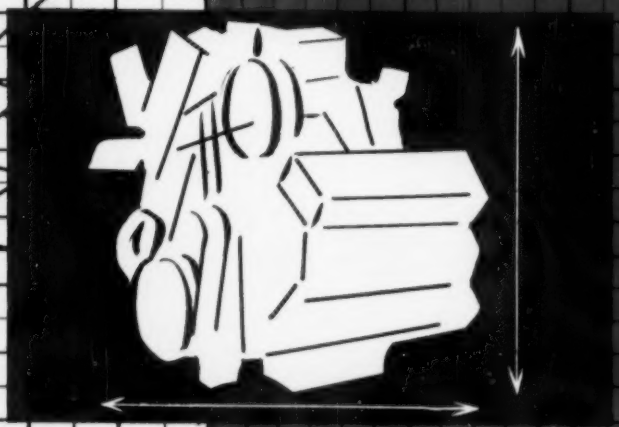
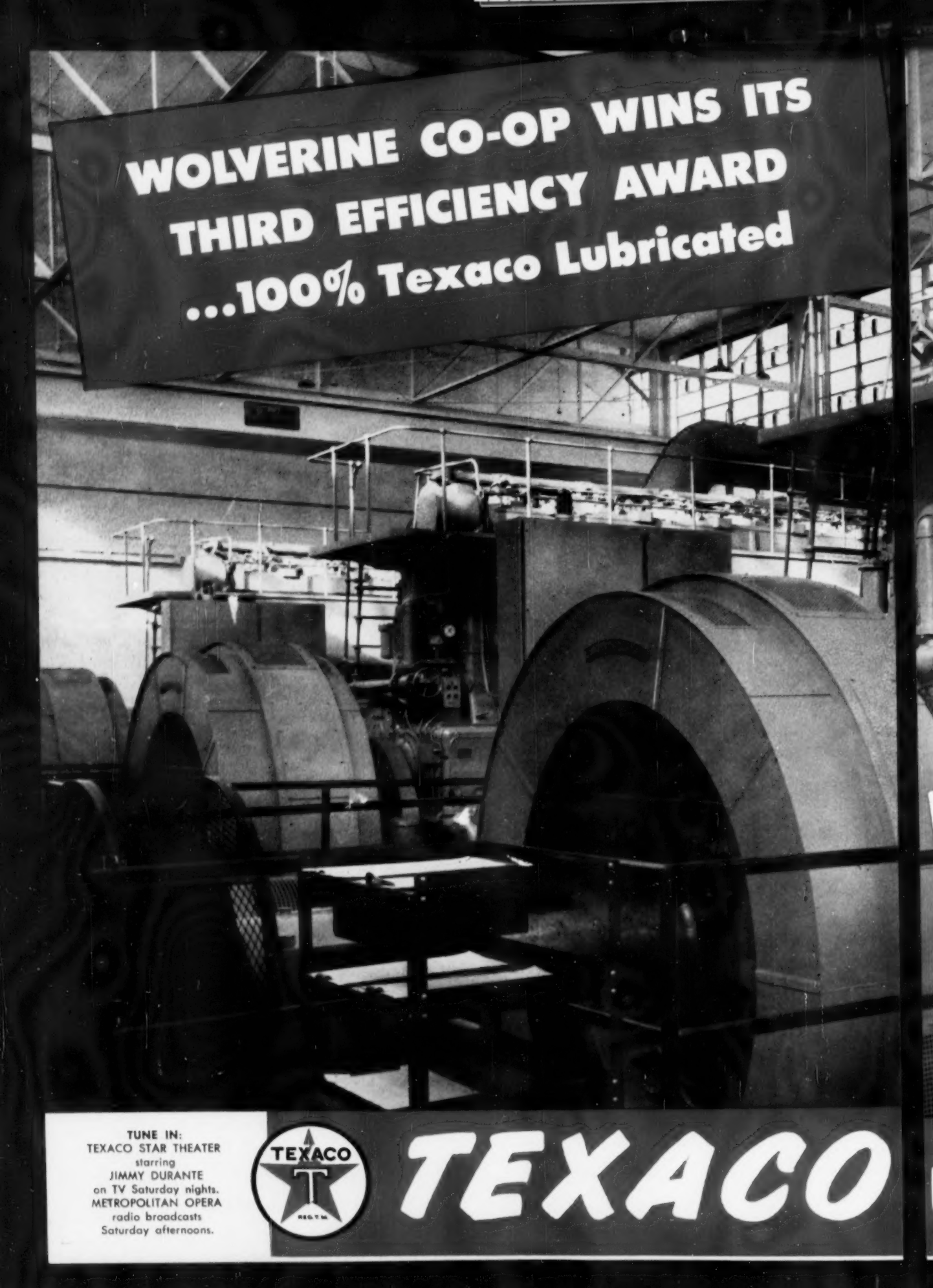
diesel power

APRIL 1956





ENGINE SPECIFICATIONS NUMBER



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on TV Saturday nights.
METROPOLITAN OPERA
radio broadcasts
Saturday afternoons.

TEXACO

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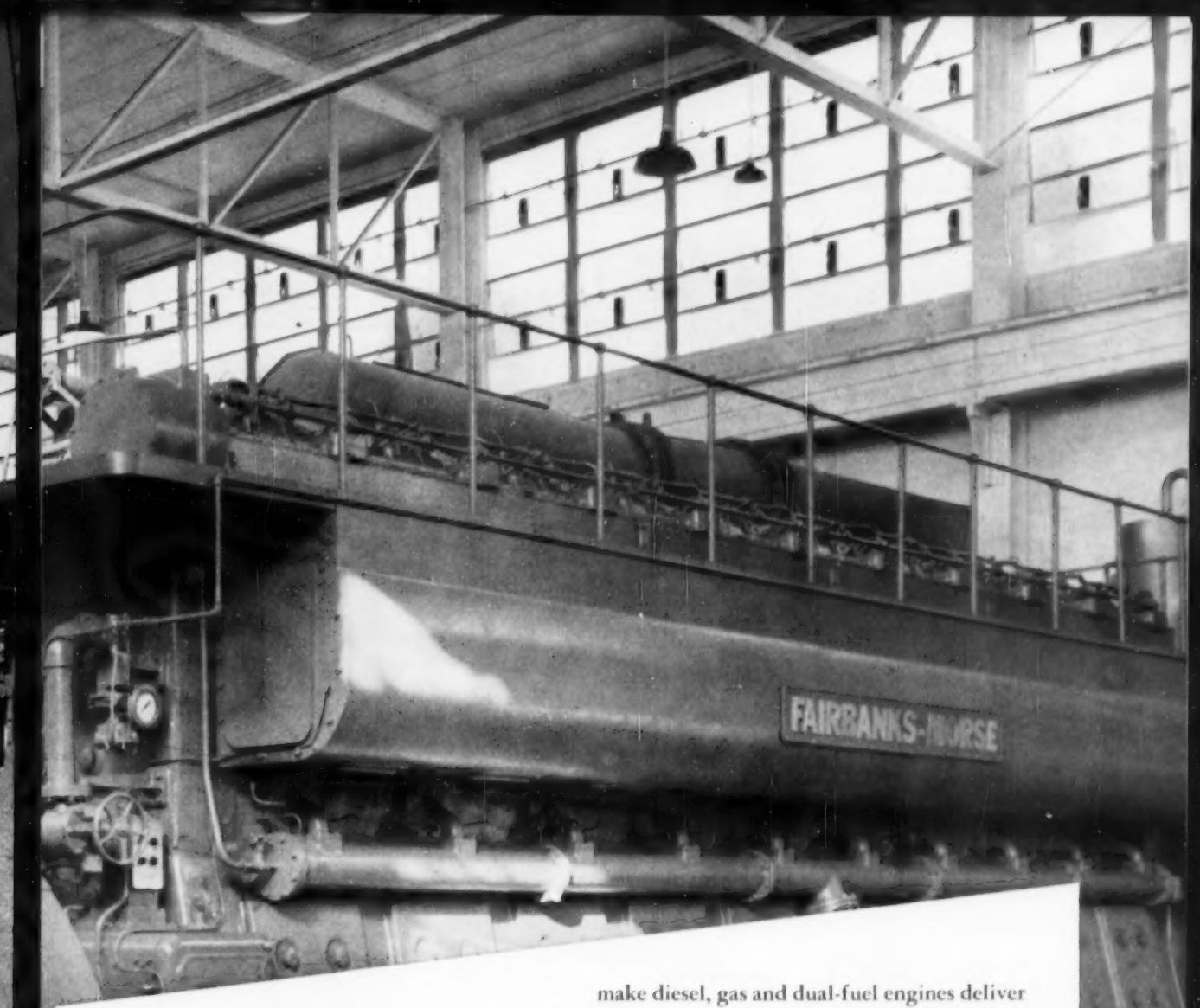

THREE TIMES now, the Hersey Plant of the Wolverine Electric Cooperative at Big Rapids, Michigan, has won the Diesel Progress award for efficient operation.

Texaco Ursa Oil Heavy Duty lubricates all six engines—three 10-cylinder Fairbanks-Morse units and three 8-cylinder Cooper-Bessemers. Average lube oil consumption is .000592 gallons/kwh. Fuel cost is only 5.14 mills/kwh.

Texaco Ursa Oil Heavy Duty is one of the famous *Texaco Ursa Oil* series—designed to make diesel, gas and dual-fuel engines deliver *more power* with *less fuel* over *longer periods* between overhauls. These benefits, consistently delivered, are the reason why—

For over 20 years, more stationary diesel h.p. in the U. S. has been lubricated with Texaco than with any other brand.

A Texaco Lubrication Engineer will gladly help your plant win new highs in efficient operation. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

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You can get more earning hours

in passenger service with Delco-Remy heavy-duty electrical equipment

Delco-Remy's hard-working heavy-duty A.C. generators are tailor-made for dependable crosscountry or crosstown busses with extra-heavy electrical loads.

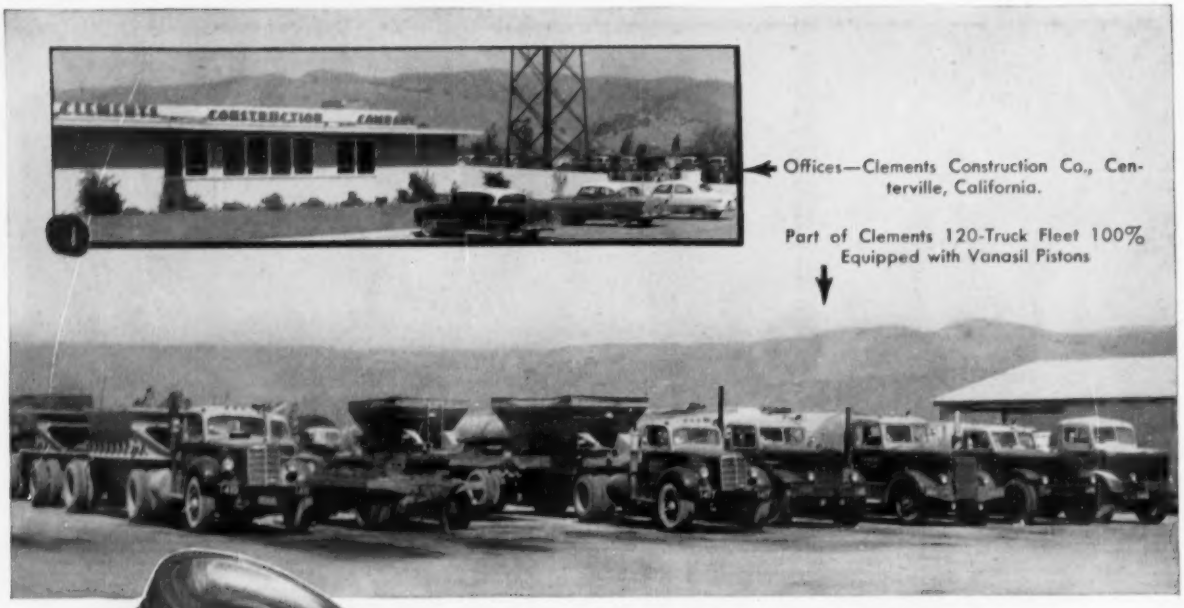
Desirable performance characteristics include cut-in at low generator rpm . . . maximum output of 180 amperes at low to medium speeds. With companion rectifiers and regulators these new generators can supply both alternating current for fluorescent lighting and direct current for the heaviest electrical loads coupled with lengthy engine-at-idle periods.

Impressive features of the new generators are their light weight, very high output capacity, and ability to operate over a wide speed range with greatest efficiency.

Delco-Remy also makes other heavy-duty electrical units, including the new longer life Delco batteries. Whether you're modernizing old vehicles or ordering new ones, be sure to specify Delco-Remy heavy-duty electrical equipment.

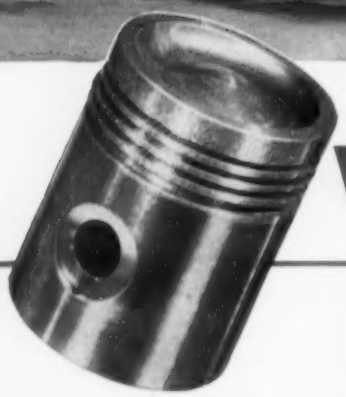
DELCO REMY • DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

ARTING WITH **Delco-Remy** ELECTRICAL SYSTEMS



Offices—Clements Construction Co., Centerville, California.

Part of Clements 120-Truck Fleet 100% Equipped with Vanasil Pistons



contractor's 120-truck fleet uses

VANASIL PISTONS 100%

CLEMENTS CONSTRUCTION CO.
CONTRACTORS
CENTERVILLE, CALIFORNIA

Gillett & Eaton, Inc.
Lake City, Minn.

Gentlemen:

About two and a half years ago we began using your Vanasil Pistons in our heavy duty trucks and pickups. Their performance is so far superior that at the present time our entire fleet of more than 120 trucks is Vanasil equipped.

We have noticed a very definite improvement in the operation of every truck and engines are running many more miles between overhauls. When the engines are reconditioned after much longer use, we find no excessive piston or top ring groove wear and little cylinder wall wear.

It is difficult to get an accurate gasoline consumption check with our type of operation, but everyone including the drivers feels that we are getting better gas mileage and also low oil consumption.

Due to our complete satisfaction with the performance of Vanasil Pistons, we are now installing them in our stationary engines and tractors as they come due for overhaul.

Very truly yours,
George A. Young
George A. Young
Vice President

Clements Construction Co.,
V. P. George Young reports:

- ★ **Better engine performance**
- ★ **More miles between overhauls**
- ★ **Less top ring groove, cylinder wall wear**
- ★ **Better gas and oil economy**

HERE'S DIESEL PERFORMANCE!

DENVER—90,000 MILES

in a 300 H. P. Cummins Diesel—and Vanasil Pistons were found to be perfect when engine was disassembled.

FT. BRAGG, CAL.—83,750 MILES

in truck No. 23 with Cummins NHRS 300 engine. "Miking" the pistons showed no wear and ring grooves were perfect. Vanasil Pistons were put back in service with a new set of sleeves and rings.

(Names of above operators on request)

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G & E Vanasil Pistons are as light as aluminum, but wear like iron! Vanasil is a patented silicon-aluminum alloy that absorbs oil—minimizes scoring and scuffing. Available for both gasoline and diesel engines. Write for price lists.

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COLORADO	Denver Bearing Co., 780 Lincoln St., Denver 2.
NEW YORK	Bethlehem Equipment Co., 109 W. 64th St., New York 23.

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diesel power

Established in 1923 **Vol. 34, No. 4** **April, 1956**

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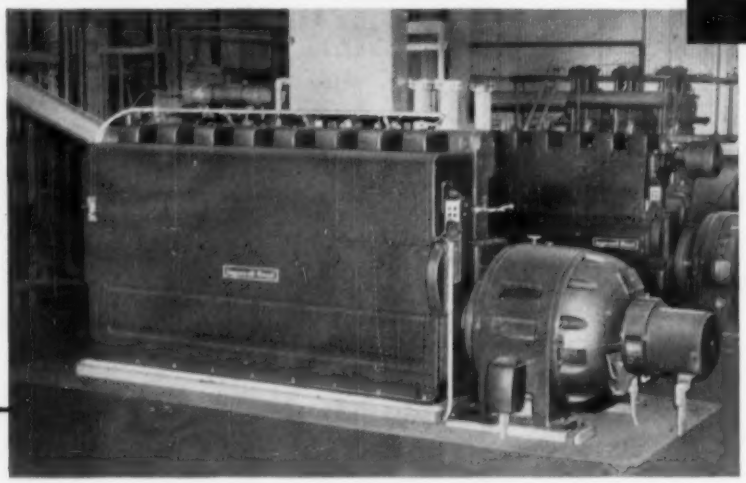


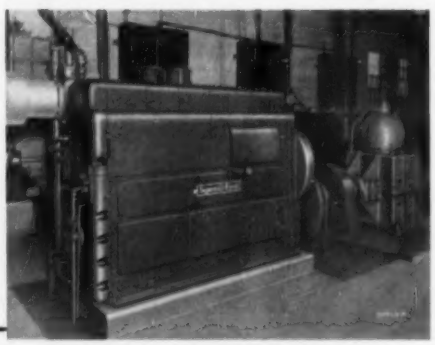
Three Ingersoll-Rand Type "S" Diesel Engines installed in a generator room of large brewery.

Type "S" and "SS"

375 to 1000 hp

Ingersoll-Rand Type "S" and "SS" engines include all of the latest advances in diesel engineering. Their modern design assures maximum fuel economy and lasting dependability in continuous, heavy-duty service.

The Type "S" is a naturally-aspirated, 4-cycle, medium-speed engine with exceptionally high fuel economy at all loads. It is available in 375, 450, 525 and 600 hp sizes. Type "SS" units are turbo-charged and rated at 570, 715, 785 and 900 hp. With inter-cooling of charging air they will develop 600, 750, 875 and 1,000 hp. Both the "S" and "SS" engines operate at 720 or 750 rpm depending on the application.



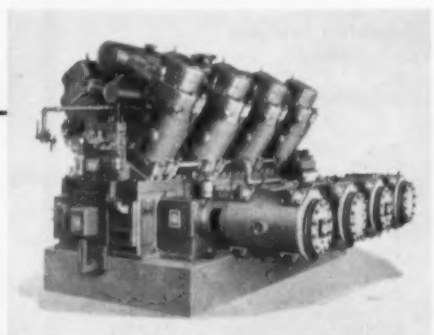
Ingersoll-Rand 6-cylinder Type "TS" Diesel driving an I-R vertical water pump at a paper mill.

Type "TS", 200-380 hp

The Ingersoll-Rand "TS" diesel is a smaller, lighter-weight engine that includes all the long-life features, stamina and dependability of big-engine design. Its high fuel economy and low weight of 30 lb/hp save operating and installation costs. "TS" units are available in sizes from 200 to 380 hp at 900-1200 rpm.

Type "SVO" Diesel-Driven Compressors

Ingersoll-Rand Diesel-driven compressors combine a heavy-duty V 4-cycle diesel engine and a heavy-duty, double-acting air or gas compressor in a single, compact machine that's easy to install . . . easy to locate. They assure maximum compression per pound of fuel —one gallon of fuel oil compressing 6040 cu ft of air to 100 psi. Available with compressor cylinders for any pressure or vacuum in a range of sizes up to 660 hp.



Ingersoll-Rand Type "SVO" diesel-engine-driven air compressor.

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Mr. Stone, Supervisor of Distributor Sales for Clark Equipment, is an engineer and sales executive of 19 years experience with leading automotive equipment builders.

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MAX RICHLER

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Max Richler and his brothers, old-established equipment house, sell Clark's automotive line in Ontario, Quebec; with service facilities and parts at Montreal and Toronto.

comprehensive service covering

ENGINE TORQUE

For more than half a century, Clark Equipment has focused its engineering attention on a Vital Area of machinery performance—the Transmission of Engine Torque.

From that planned specialization came Clark axles, Clark transmissions and the Clark one-piece forged axle housing; and finally, as a natural evolution, the Clark torque converter.

Better Power-Trains = Better Machines

When the first Clark fork-lift truck was born in 1927, Clark applied its know-how and torque transmission experience to developing power-train systems for this new type of vehicle.

Again, in recent years, Clark developed a revolutionary power-train for its own newly developed tractor shovel; and almost overnight became a major factor in the construction machinery industry.

What could be more natural than that other manufacturers of agricultural and industrial machinery, recognizing Clark's unique asset of power transmission experience and expertness, should ask for Clark collaboration in developing driving units of functional design for their own products?—ask for it, and get it.

So today it can be said of many modern machines, Clark-built and others: "From engine flywheel to point of power use—torque transmission system designed and manufactured by Clark Equipment."

NOW: A Service to Users

Today that invincibly logical Clark development has an equally logical sequel: a complete Power Transmission Service to users of diesel or gasoline horsepower—from flywheel to point of torque application.

That service is implemented as follows:

- **District Sales Engineers—A nation-wide organization of men fully qualified to help solve technical problems**
- **Independent Equipment Dealers—Long established businesses of high reputation and well staffed; to distribute Clark products direct to users in certain key industries**
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As a user of diesel or gasoline horsepower, always on the lookout to get the best possible performance at lowest possible costs, you'll find it good business to establish a working relationship with Clark, through its nearest representative.

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In Texas, Clark's automotive line is handled by H. A. Davis Power Equipment Co., leading distributor, with complete sales, service and parts inventories.

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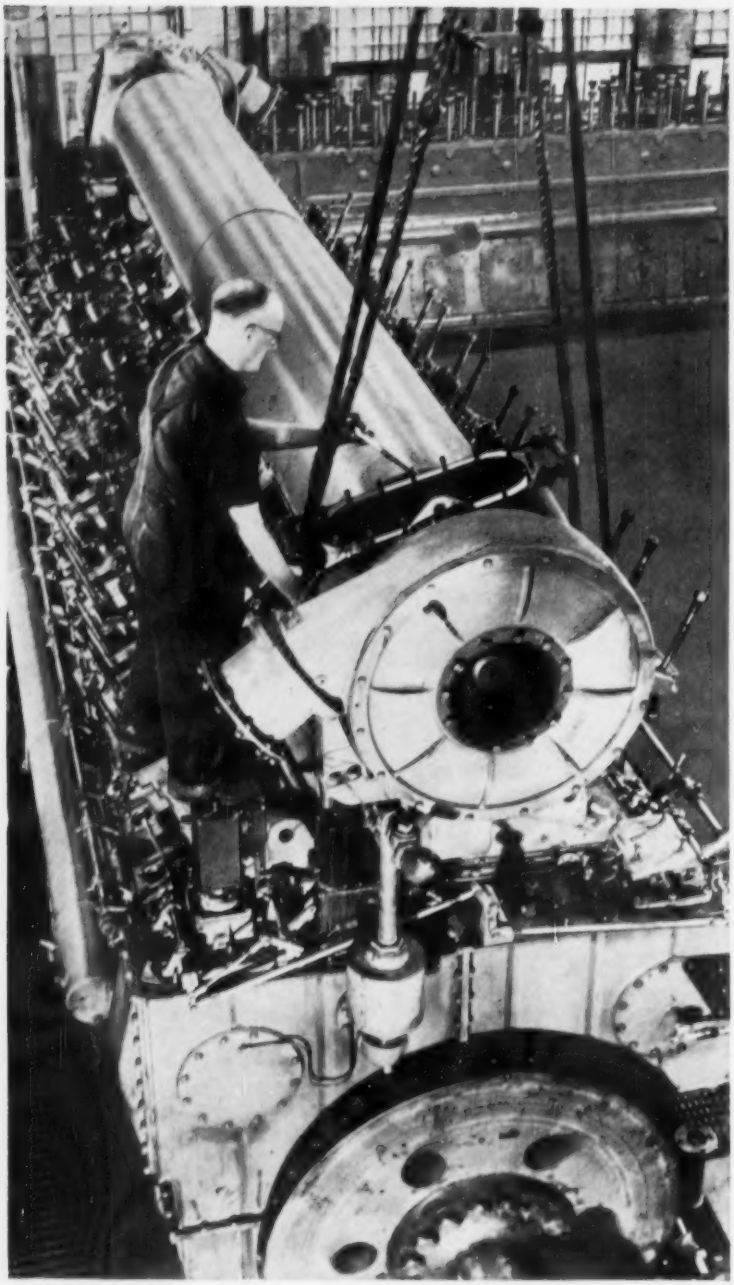

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America's first big diesel built to take full advantage of turbocharging

America's first diesel designed and built for turbocharged operation up to 5,000 hp has been hailed as the greatest power engine advance in over twenty years. Fourteen engines on order in its first production year prove unusual user acceptance. Some important reasons for this success are massive component design, compact construction for lower foundation and installation costs, and continuous high power operation on the most economical, locally available fuels.

Worthington's SW 14 offers you performance ratings that are conservative by *any* standard. You can only get this degree of reliability in a turbocharged engine when it's designed specifically for high cylinder pressures under continuous heavy duty operation. A "souped-up" engine just doesn't meet SW 14 standards.

It's as easy as calling your nearest Worthington Office to get the whole story on the SW 14, or write Worthington Corporation, Section E61, Harrison, New Jersey, for Bulletin S-500-B60.

E61

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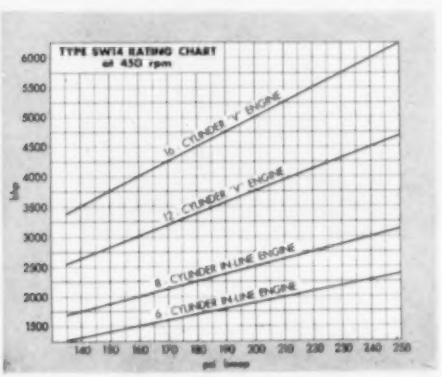
ECONOMICAL, CONTINUOUS POWER

Diesel, Dual-Fuel and Spark-Ignition Engines from 150 to 5000 BHP



Diamond ring for a diesel

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Crankcase dilution can be a big headache. But not for one of the leading Diesel manufacturers. They knew that the right injection nozzle seal would cure a major cause . . . and came to C/R Sirvene engineers for help. C/R manufactured this Sirvene (synthetic rubber) part to extremely critical dimensions and physical properties to match the equally precise dimensions of the assembly. Result: no more leakage. When you need a pliable mechanical part compounded to meet critical specifications of heat, pressure, abrasion resistance and molded to the most exacting tolerances, you need C/R Sirvene. C/R Sirvene engineers will gladly cooperate with you in all phases of your sealing problem . . . from design, compounding of the correct oil-resistant elastomers, through laboratory-like control of production quantities. Write for your copy of the new booklet, "Sirvene."

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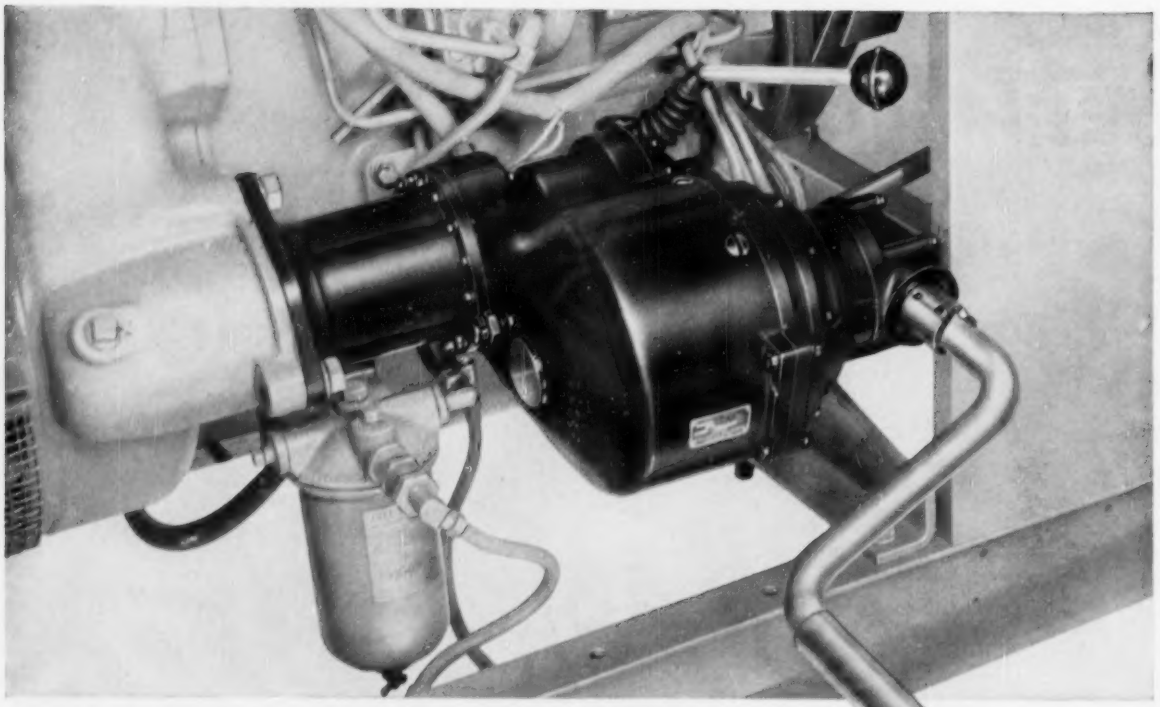

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HAND-CRANKED INERTIA STARTER

RUGGED, SIMPLE AND DEPENDABLE—This new hand-cranked inertia starter . . . available in four different models . . . is especially suited for use in remote areas and under difficult operating and climatic conditions.

Use the Bendix AE Inertia Starter where shock conditions can damage storage batteries or disrupt voltage regulation. Use it where battery maintenance is a problem or where there is a fire hazard. Replaces regular electric starter—no alterations to mounting flange needed.

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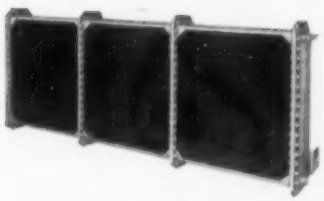

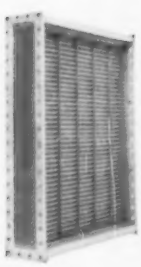

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The Rocket's en route . . . and right on schedule! The Rock Island's famous streamliner blazes by village and town . . . racing with time . . . and on top of the heat *all the time.* For Harrison tracks down temperatures for the long haul. These heavy-duty lube oil and jacket water coolers keep heat down . . . keep engines running at peak performance. Harrison coolers are rugged, reliable and compact . . . ready for duty on today's most modern diesel engines. That's why Harrison heat exchangers ride the majority of modern locomotives today. If you have a cooling problem, look to Harrison for the answer.

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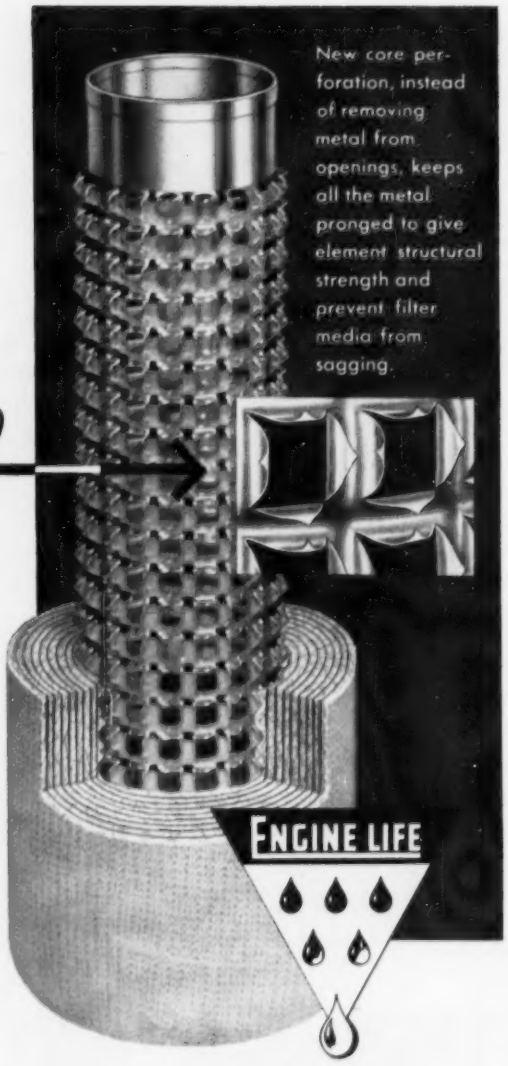
ENGINE LIFE *Maxiflo*

UNRESTRICTED CORE


New core perforation, instead of removing metal from openings, keeps all the metal pronged to give element structural strength and prevent filter media from sagging.
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DESIGNED TO GIVE MAXIMUM FLOW AND FILTRATION

Conditions oil without restricting flow

Here's a brand new ENGINE LIFE exclusive that gives unrestricted oil flow without sacrificing strength. This new core development which required research and development of special machines and tooling right in our own plant, gives you the finest full flow oil filtering yet. Now, even the most viscous lubricating oils and fuels are filtered perfectly. Because core openings can handle up to 10 times the oil pumped through the system, the most excessive surges are easily handled, thereby protecting the hydraulic system from undue restriction and ultimate failure. All integral parts of the new Maxiflo core are of non-corrosive metal.

With Maxiflow, as in all Engine Life Elements, consistency in diameter and length is maintained

ENGINE LIFE elements operate without impairing the hydraulics of your engine. Better oil conditioning is achieved through the ENGINE LIFE absorption method of full filtration. All ENGINE LIFE elements are engineered to meet requirements of your application.

ENGINEERED FOR ALL REQUIREMENTS

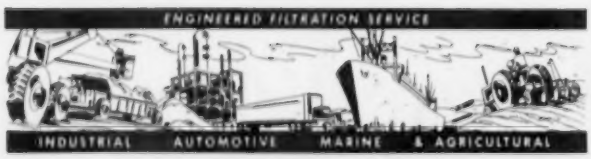
Lubrication system flow rates are maintained by the free area ratio of perforation. Openings equal up to 10 times amount of oil volume pumped through engine.

Non-corrosive Metal Cores are end sealed with metal rings to insure trueness, add lip strength.

A COMPLETE LINE OF FILTERS AND REPLACEMENT ELEMENTS

ENGINE LIFE *PRODUCTS CORPORATION*

EL MONTE, CALIFORNIA



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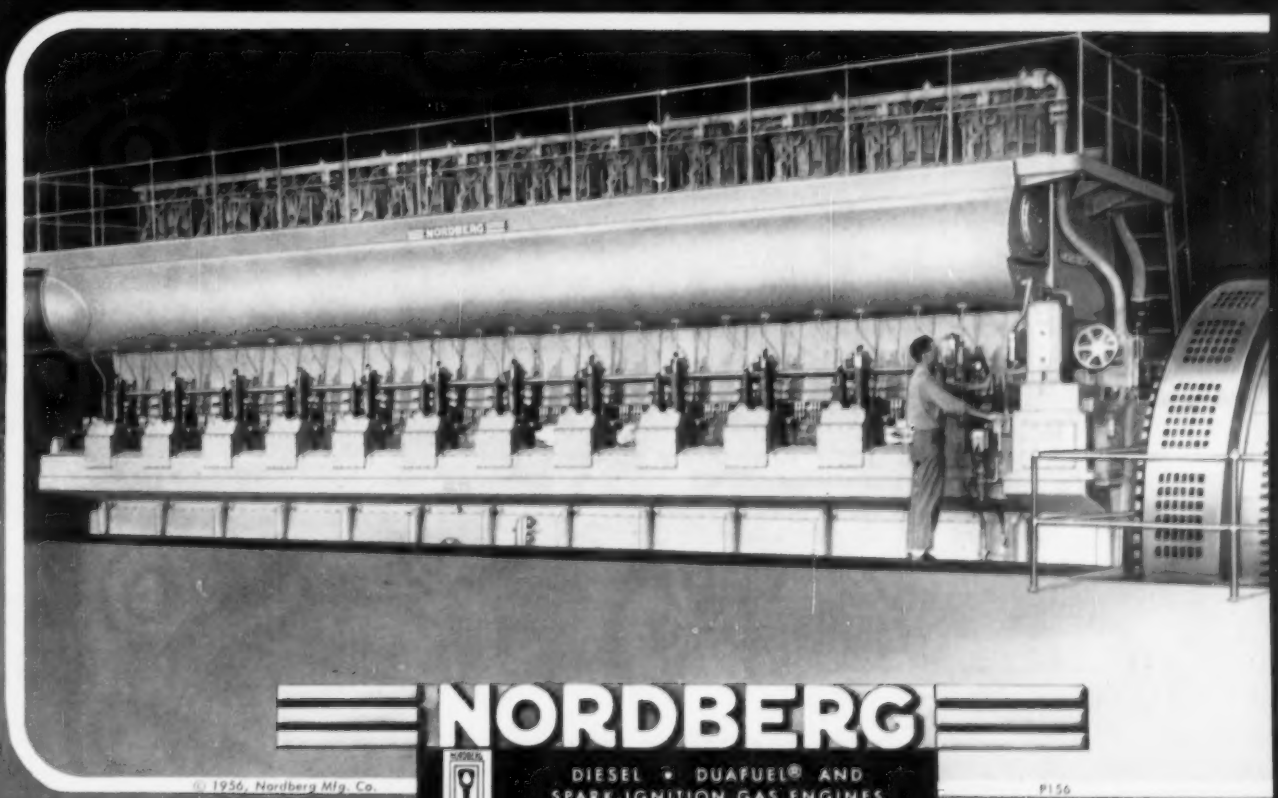
makes Nordberg Engines your logical choice for power generation

Nordberg, a pioneer in the Diesel and Gas engine industry in the United States, has always occupied a prominent position among the world's leading builders of internal combustion engines. Over the many years Nordberg has contributed many of the most notable advancements in the development of more efficient prime movers . . . all in the interest of improved fuel economy, simplicity of design, less maintenance and better overall performance.

Nordberg research, engineering and development continues to direct its efforts toward further achievements by intelligently anticipating power requirements. As a result of these efforts Nordberg today . . . with a full range of engine sizes from 10 to over 12,000 horsepower including Diesel, Duafuel® and Spark-Ignition Gas types . . . is in the best position to solve your specific power problems.

Write for further information.

NORDBERG MFG. CO., Milwaukee, Wisconsin



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P156

A SET OF MATCHED IRONS

to improve Diesel and Gas Engine Performance

Like a golfer's set of matched clubs, each piston ring in a PEDRICK ENGINEERED SET is picked for its special ability to do its particular job more efficiently than any other ring. Consequently, PEDRICK ENGINEERED SETS are best able to meet the *individual* requirements of different engines. From top piston groove to bottom, PEDRICK RINGS deliver complete blow-by control, maximum lubrications with minimum oil waste, a more perfect seal for higher compression and longer life *plus* full power for every engine.

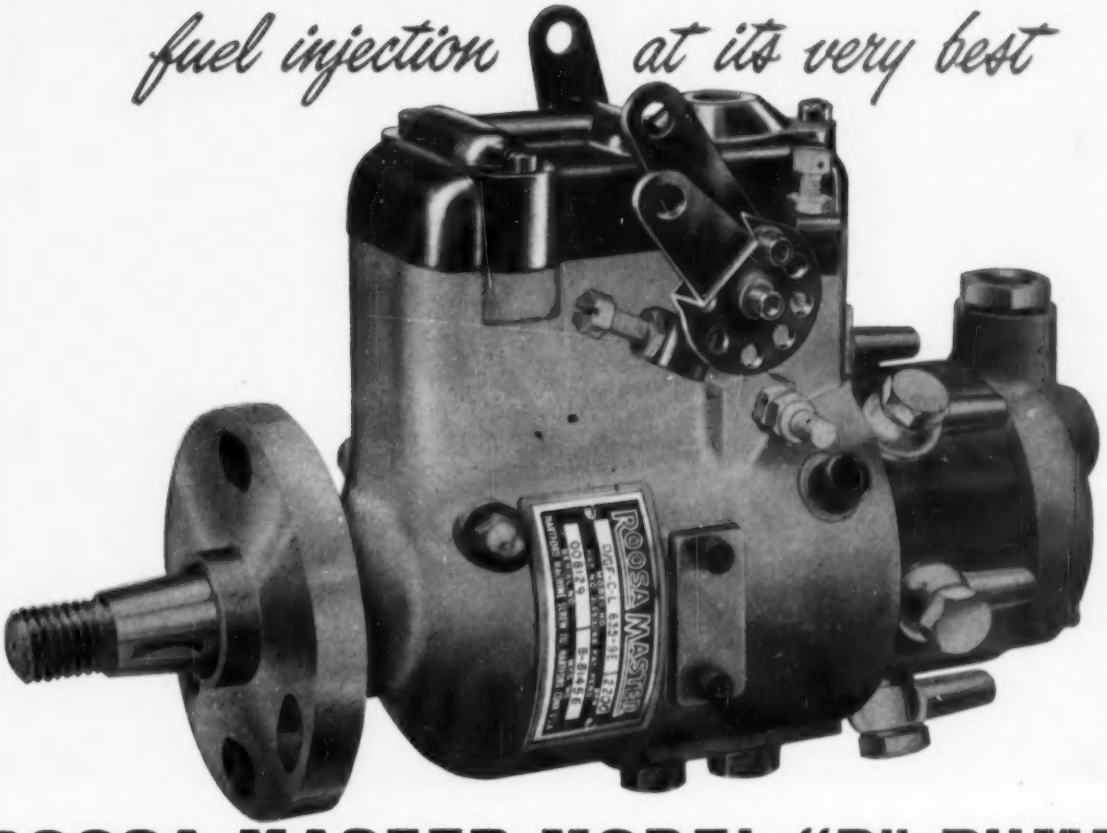
Whatever your requirements . . . engineered sets or single rings . . . you get more efficient performance when you specify PEDRICK PISTON RINGS. Engineering service is available to help you with special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, SAratoga 9-3770

Pedrick **PISTON RINGS**

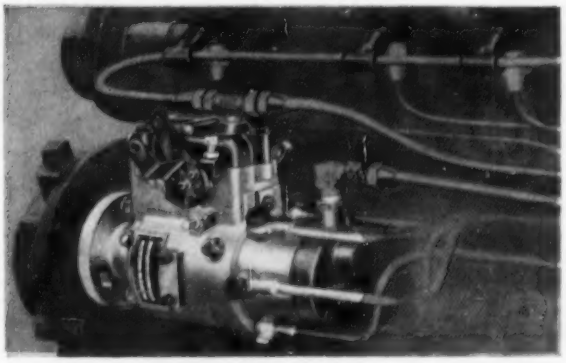
PEDRICK PRECISIONEERING KEEPS PEDRICK FIRST

SIMPLIFIED

fuel injection at its very best



ROOSA MASTER MODEL "D" PUMP



Again Roosa-Master makes a revolutionary contribution to better and simplified diesel fuel injection. The new Model D is lighter . . . smaller . . . more compact . . . yet retains the pace-setting simplified method of fuel injection pioneered by Roosa Master Model A. Designed for use with all major types of high speed engines, Model D offers both the diesel engine manufacturer and user outstanding performance, exceptional dependability and low maintenance costs through easier servicing. Write today for literature and complete information on the modern fuel injection pump that **makes good diesels better.**

You can depend on the diesel that depends on HMS ROOSA MASTER

HARTFORD MACHINE SCREW COMPANY DIVISION OF STANDARD SCREW COMPANY HARTFORD, CONN.

NEW HORIZONS IN RAIL TRAVEL

The two new lightweight General Motors Aerotrains are now touring American railroads. This great Electro-Motive development opens new horizons that might well revolutionize travel by rail. With steel underframe and aluminum body, the high-speed Aerotrain is 50% lighter than conventional trains. It costs much less to build and much less to operate.

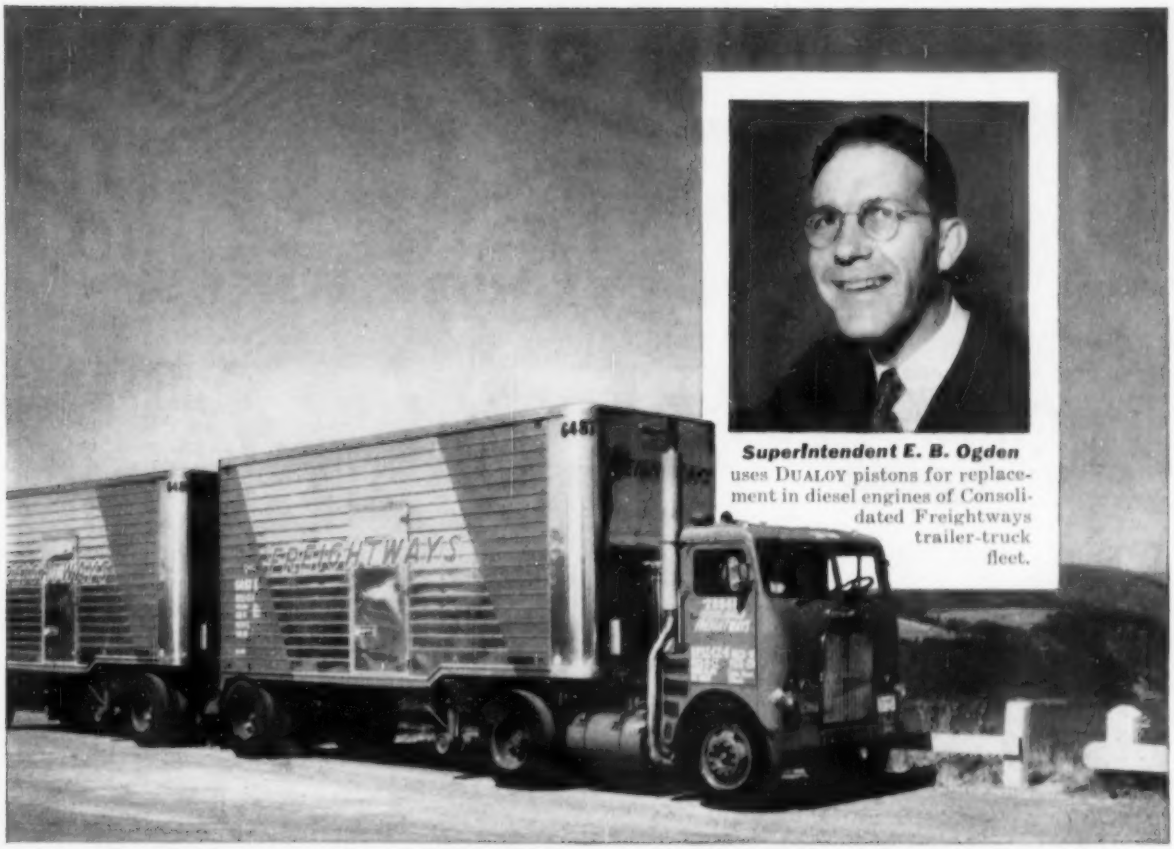
It is Electro-Motive's current contribution to the thinking designed to win passenger traffic for railroads—and help to make it profitable.

Electro-Motive Division

GENERAL MOTORS · LA GRANGE, ILLINOIS

Home of the Diesel Locomotive

In Canada: GENERAL MOTORS DIESEL, LTD., London, Ontario



SuperIntendent E. B. Ogden uses DUALOY pistons for replacement in diesel engines of Consolidated Freightways trailer-truck fleet.

Armored with Ni-Resist top ring bands, DUALOY pistons replaced conventional-type aluminum pistons in the diesel engine powering this doubles combination operated by Consolidated Freightways, Inc., Portland, Ore. DUALOY pistons with Ni-Resist ring carriers are produced by United Engine & Machine Company, San Leandro, Calif.

"We insist on Ni-Resist inserts in our replacement pistons,"

. . . says E. B. Ogden Superintendent of Maintenance, Consolidated Freightways, Inc.

". . . and we plan to continue using DUALOY pistons with NI-RESIST* top ring bands in rebuilding engines in our shops at Portland, Los Angeles, Minneapolis and Chicago."

You, too, can lessen your workload. You can watch your mileage multiply some three-fold between piston overhauls and see ring-groove wear practically vanish.

Put aluminum pistons, with Ni-Resist bonded-in top ring grooves to work in your diesel engines.

The inserts resist metal-to-metal wear and galling. Equally important, they resist attacks from corrosion and heat. In Ni-Resist inserts, your rings function properly, preventing blow-by and abnormal oil consumption. You get a step-up in power. Downtime takes a big tumble.

Ni-Resist, a nickel alloy cast iron, has many diverse uses. Actually, no other cast metal provides such a useful combination of engineering properties. Its applications include cylinder liners, valve guides and exhaust-system parts as well as ring carriers.

If such parts give *you* trouble, let us help you lick it. Fill in the coupon and mail it to us now.

*Registered trademark

The International Nickel Company, Inc.
67 Wall Street, New York 5, N. Y.
Gentlemen: We're having trouble with
☐ top ring grooves ☐ cylinder liners
☐ valve guides ☐ exhaust manifolds
due to ☐ heat ☐ corrosion ☐ wear
☐ Please send booklet "Keep Them Rolling"

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Company _____

Address _____

City _____ State _____

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N.Y.

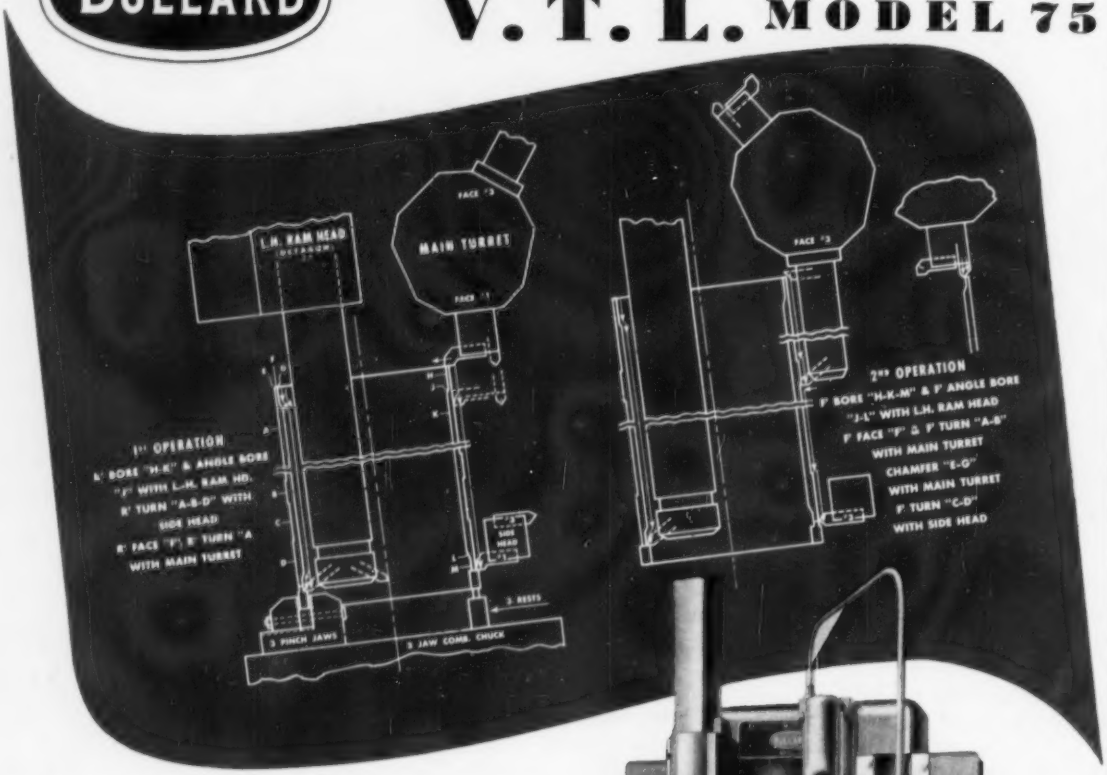
Here is a Time and Cost Saving Method of Machining

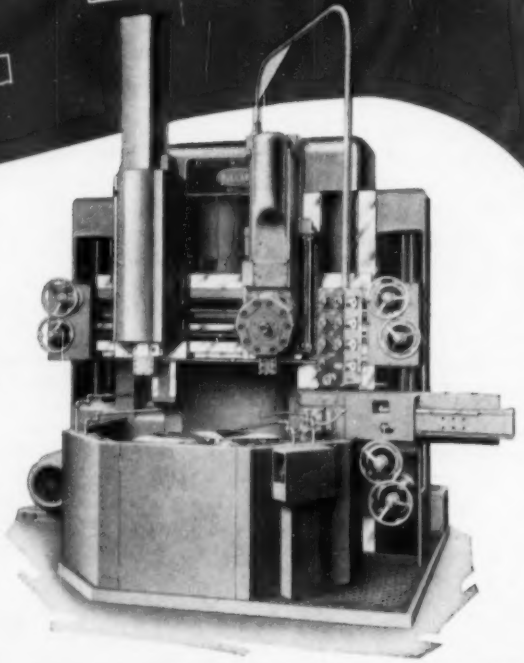
DIESEL CYLINDER LINERS

with a

BULLARD

CUT MASTER V.T.L. MODEL 75

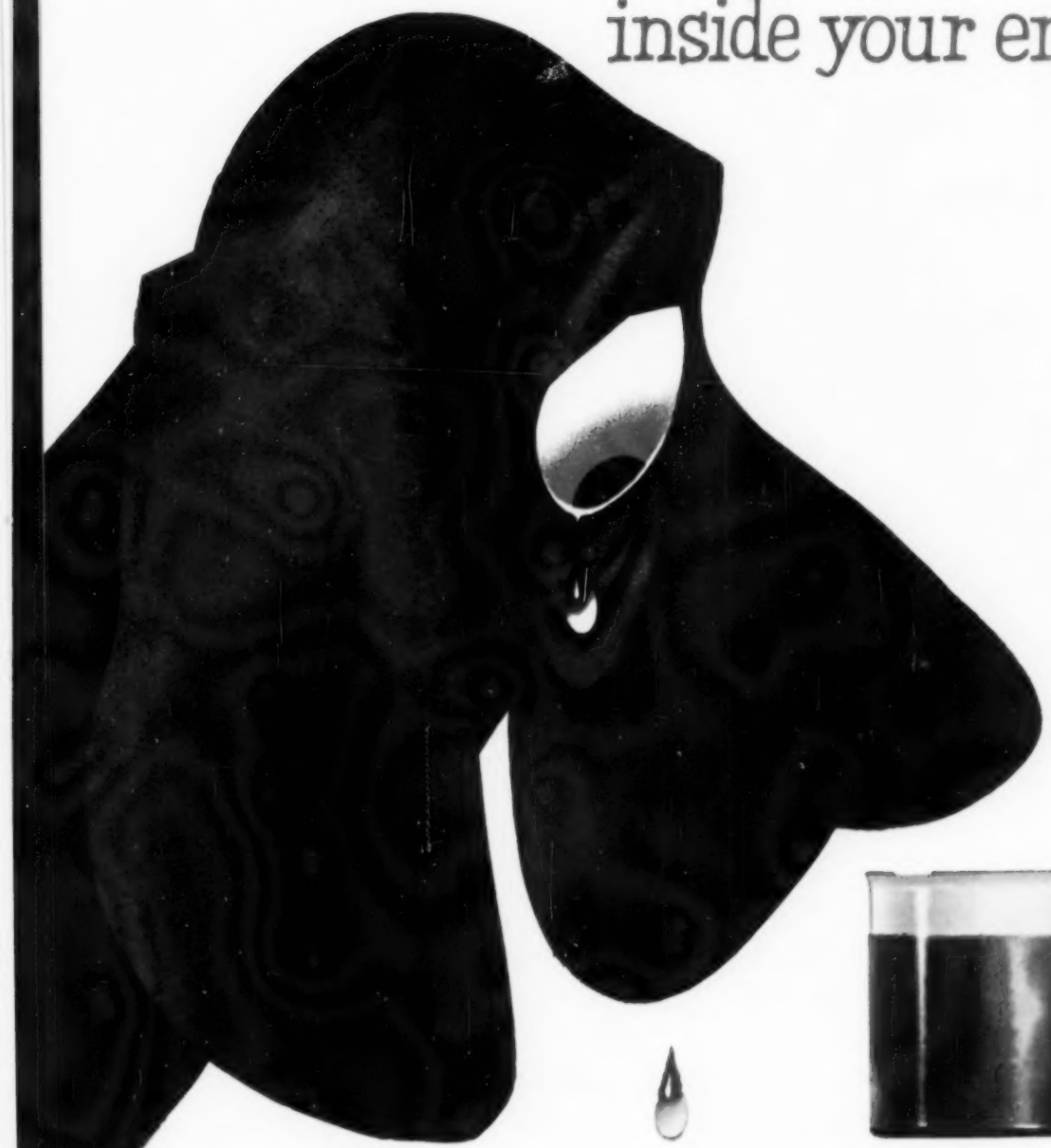

L.H. RAM HEAD
MAIN TURRET
FACE "3"
FACE "1"
1st OPERATION
L' BORE "H-K" & ANGLE BORE "J" WITH L.H. RAM HD.
R' TURN "A-B-D" WITH SIDE HEAD
R' FACE "F", R' TURN "A" WITH MAIN TURRET
2 RESTS
3 PINCH JAWS
3 JAW COMB. CHUCK
2nd OPERATION
F' BORE "H-K-M" & F' ANGLE BORE "J-L" WITH L.H. RAM HEAD
F' FACE "F" & F' TURN "A-B" WITH MAIN TURRET
CHAMFER "E-G" WITH MAIN TURRET
F' TURN "C-D" WITH SIDE HEAD



Are you getting comparable production in your shop? If not — you should and you can. Just call your nearest Bullard Sales Representative for full details or write to

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

PURE doesn't need a Bloodhound to sniff out trouble inside your engine...



Just give us one pint of your used oil . . . we'll give you a complete engine analysis—FREE!

Free Pure Oil service saves costly engine repairs

Pure-sure Used Oil Analysis tracks down hidden engine trouble . . . cuts operating costs—increases efficiency.

By analysing just one pint of used motor oil, Pure Oil scientists can give you a complete report on your fleet engine's condition. What they find may save you costly repairs. Or they may tell you how to cut operating costs. Or increase efficiency.

Pure-sure Used Oil Analysis is offered *free* on a regular basis to fleet users of Pure Oil products. They find it's just like looking inside the engine without even taking the head off. What's more, the unit is on the road carrying a payload while the analysis is being made.

To show you how valuable this free service can be to your fleet operation, Pure Oil wants to give you a *free* Used Oil Analysis for one of your units. Call your nearest Pure Oil office or mail the coupon for complete details.

This offer limited to the 24-state area where Pure Oil products are sold.

THE PURE OIL COMPANY, DEPT. 63
35 East Wacker Drive, Chicago 1, Illinois

Without cost or obligation, please send me information on how I may obtain a Pure-sure Analysis of my used oil.

Name_____

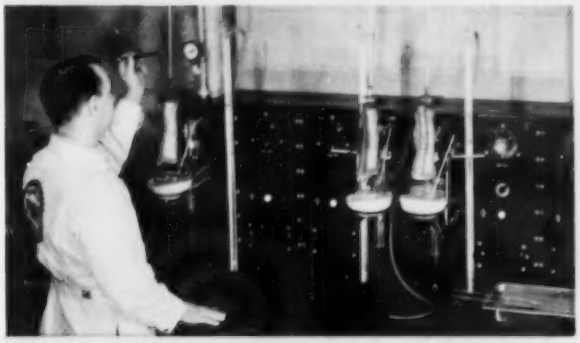
Title_____

Company_____

Address_____

City_____ Zone____ State_____

Here's how it works:



Your pint of used motor oil is run through 17 controlled laboratory tests by Pure Oil technicians in the Research and Development Laboratories at Crystal Lake, Illinois.

From the results of the analysis, a complete report is sent you recommending changes in operating procedure or warning of possible engine trouble.

Serious engine damage—such as this piston failure—can then be avoided or corrected. You save a possible big repair bill and costly down-time.

Be sure with Pure

BE SURE PURE WITH PURE

6010

With SHELL ADC* Oilprint Analysis . . .

Part of the fleet operated by Cleveland-Lorain Highway Coach Co., Lorain, Ohio, lubricated by Shell Rotella Oil and protected by Shell ADC* Oilprint Analysis.

"Extended oil drain intervals... lower repair costs"

HERE'S ANOTHER transportation company that has found the Shell ADC* Oilprint Analysis a cost-saving tool of preventive maintenance. By its use, oil drain intervals have been extended safely on some new diesel coaches.

Furthermore this fast, reliable oil check has revealed many potential troubles in advance, such as oil contamination due to block fracture . . . in time to save costly repair bills. The Cleveland-Lorain Highway Coach Co. is enthusiastic about it.

The Shell ADC Oilprint Analysis enables fleet operators to test crankcase oil in the short time allotted for re-fueling and crankcase oil checks . . . mere *minutes*. It eliminates draining still-good oil and the risk of using oils loaded with contaminants.

Let us demonstrate how we can put this new cost-saving PM tool to work for you.

*Trademark

One Drop tells the Story!

The operator places just one drop of oil on the card. Analysis gives conclusive check of oil's condition.

SHELL OIL COMPANY

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100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

KAHLENBERG CHOSE *NAPIER*

Napier turbo-blowers fitted to 2-stroke Marine diesel engines are currently increasing power output by at least 30% and even more on industrial applications. Or—if you prefer it this way—with a Napier turbo-blower you can get the same amount of power from a much smaller engine. Specific fuel consumption is no higher and can often be reduced. They are available in seven sizes to suit engines of approximately 140 h.p. to 4,000 h.p. Multiple installations are available for engines of higher powers.

KAHLENBERG BROS. CO., have installed *NAPIER* Turbo-Blowers on their latest Model E6 Two-stroke, uniflow scavenged Marine Engine.

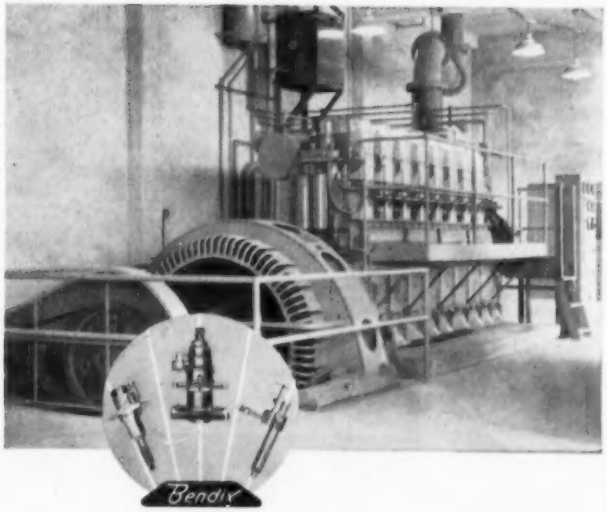
NAPIER Turbo-blowers

IN USE IN 56 DIFFERENT COUNTRIES

D. Napier & Son Limited. 211 The Vale, London, W. 3. | Representative: L. O. Brooks, Suite 909, Dupont Circle Building, 1346 Connecticut Avenue, Washington 6, D. C.

ENTERPRISE 1000 KW DIESEL GENERATOR WITH

Bendix FUEL INJECTION EQUIPMENT!



Providing emergency power facilities for the vast, new San Francisco International Airport is no small task. Yet, the Enterprise Diesel Generator with Bendix* Fuel Injection Equipment, set for standby duty at this modern new airport, is prepared to quickly deliver ample emergency power.

As you can appreciate, specifications met by Enterprise engineers in making the installation were rigid.

First, within 15 seconds after any power failure, the Enterprise engine starts up and cuts in automatically on the landing light and runway light circuit. Then, in less than 15 minutes, full load is attained to power storm sewer, pumps, necessary emergency equipment, terminal, concourse and tower lighting. It was further required that the Bendix equipped power plant provide continuous full-load operation for weeks or even months without "shutdown". Actually, this mighty standby generator in prior tests not only met, but actually surpassed these rugged requirements.

Here, once again, is proof that when operating conditions demand unfailing dependability, Bendix Fuel Injection Equipment is the choice of leading diesel engine manufacturers.

*REG. U.S. PAT. OFF.

SCINTILLA DIVISION, BENDIX AVIATION CORPORATION
SIDNEY, NEW YORK

Export Sales and Service:
Bendix International Division, 205 East 42nd St., New York 17, N. Y.

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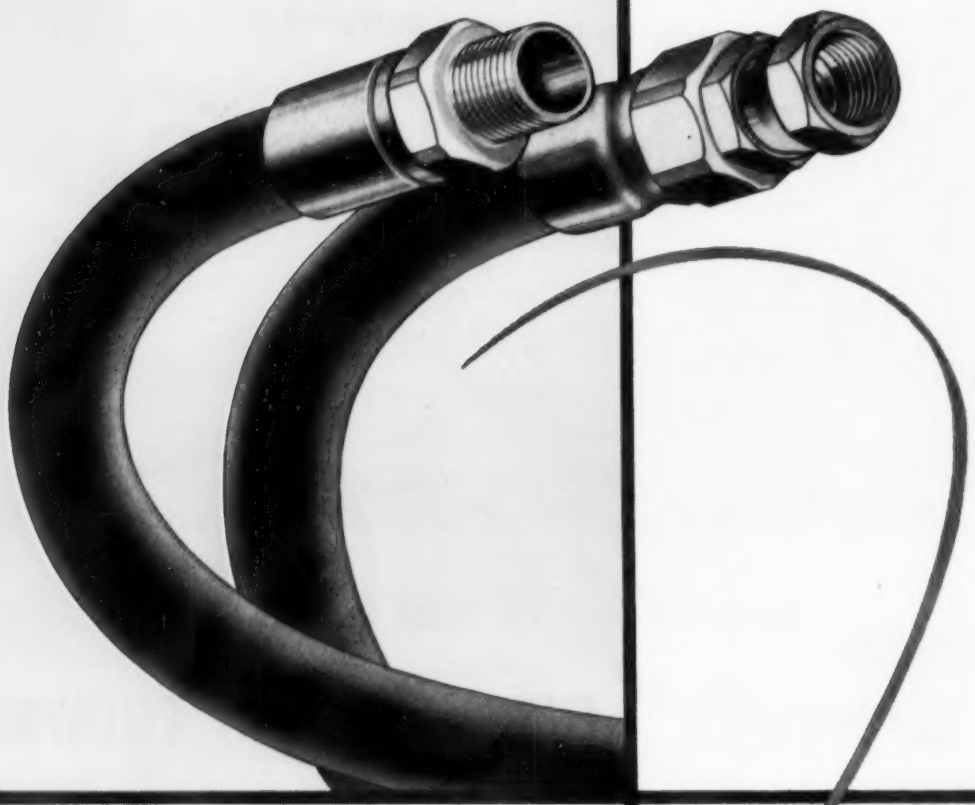
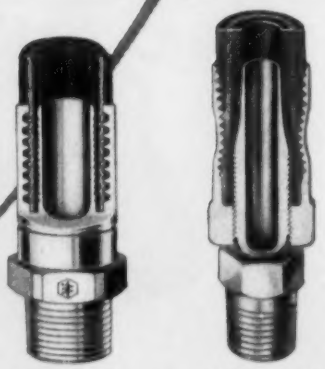
Bendix
AVIATION CORPORATION

When the pressure is on...



For original equipment that's durable and dependable . . . for time-saving field installations that keep the job rolling . . . specify Weatherhead hydraulic hose lines. On diesel engine installation and maintenance, Weatherhead has long been recognized as the leading source of supply for hose and hose ends to meet any need. Weatherhead is geared to meet industry's toughest requirements.



SWAGED TYPE REUSABLE TYPE

Contact Your Nearby Weatherhead Distributor Now!

WEATHERHEAD

THE WEATHERHEAD COMPANY

FORT WAYNE DIVISION • DEPT. E-4
128 W. WASHINGTON BLVD., FORT WAYNE, IND.
In Canada: The Weatherhead Co., Ltd., St. Thomas, Ontario

Weatherhead "right-now" distributor service is important to you, too. Any swaged hose assembly made in 3 minutes . . . in any length, size, type or pressure. Bulk hose and reusable hose ends immediately available from stock.

CLEVITE* 77 *tri-metal* BEARINGS

- wear longer under rough usage
- improve engine performance
- cut "down-time"
- reduce maintenance
- improve your operating profit

● The remarkable **CLEVITE 77** bearing — the closest approach to a *perfect* heavy-duty bearing yet devised —does all of these things. Here is what one leading truck manufacturer says: "The bearings known as Clevite 77, are recognized as being the finest now available for truck operation. The importance of Clevite 77 bearings cannot be over-emphasized for they not only reduce bearing, crankshaft and connecting rod maintenance costs, but also assure longer power plant life, which means lower ton-mile truck operating costs."

CLEVITE 77 will pay *you* dividends when you install this finest precision quality bearing in *all* your repair work on heavy-duty equipment.

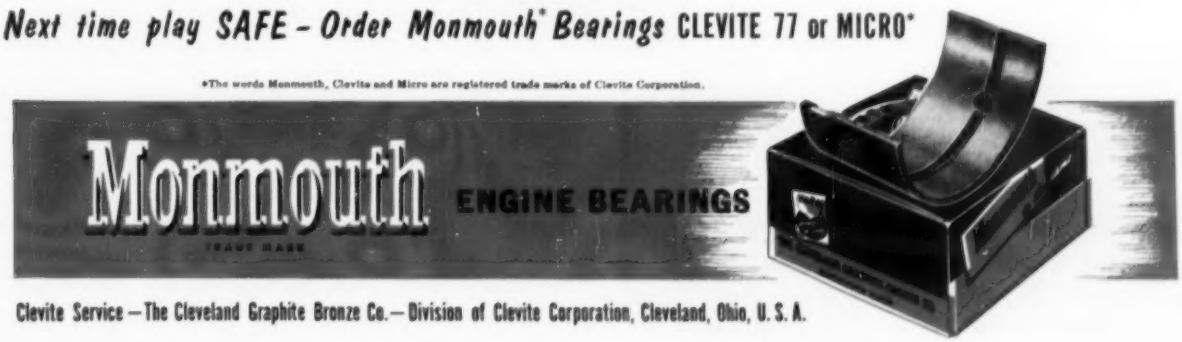
CLEVITE 77 is sold everywhere—through a nation-wide network of N.A.P.A. jobbers.

Stocks are *complete* . . . prices *right* and service is *the best!*

Your NAPA Jobber is a Good Man to Know!

Next time play SAFE – Order Monmouth* Bearings CLEVITE 77 or MICRO

*The words Monmouth, Clevite and Micro are registered trade marks of Clevite Corporation.



Clevite Service—The Cleveland Graphite Bronze Co.—Division of Clevite Corporation, Cleveland, Ohio, U. S. A.

cut your diesel maintenance costs with

PUROLATOR

in these three spots

Even the cleanest fuel supply brings damaging dust, dirt and grit into your diesel engine. Without filtration, injection pumps gall, wear and lose their accuracy. Nozzles get plugged and burn. Even if your engine goes on running, the power output of individual cylinders goes badly out of balance.

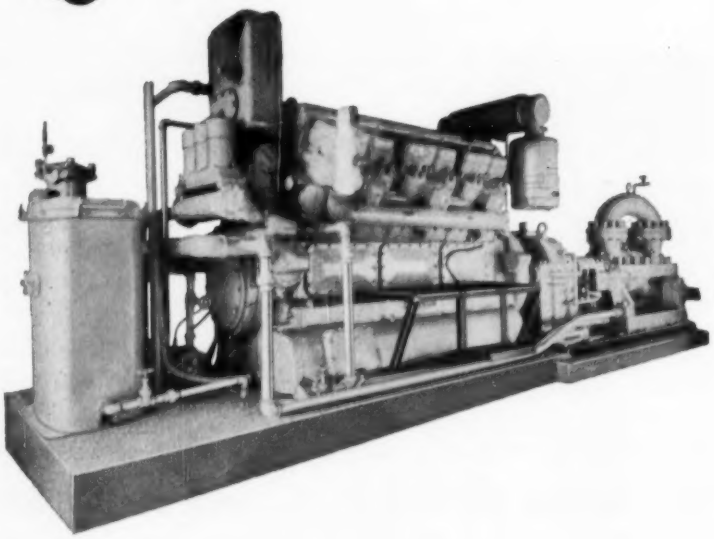
So . . . effective fuel oil filtration is absolutely essential. For your engine to keep running at peak efficiency and with minimum outlay for maintenance, its fuel system should be equipped with PUROLATORS in the three areas listed at the right.

For details of the PUROLATOR models designed for use in these diesel applications, write today for the PUROLATOR diesel catalog. Address Purolator Products, Inc., Rahway, N. J., Dept. DPI-411

Immediately before and after the transfer pump. The PUROLATOR on the suction side protects the pump. The one on the pressure side takes out any bits of metal worn from the moving pump parts.

In the fuel line before the injection pump. A PUROLATOR here is an inexpensive way to assure smooth, wear-free operation of the injection pump.

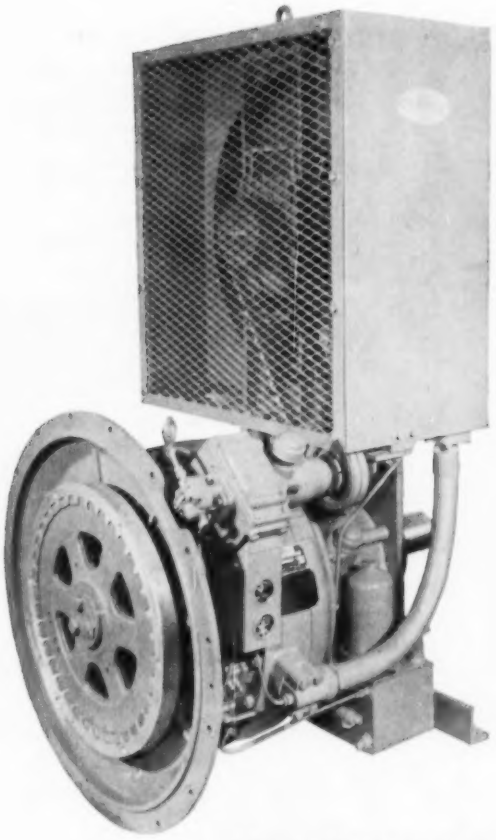
Built into each injection nozzle. While there is no obvious source of contamination beyond the injection pump, experience shows that an individual metal-edge filter element built into each nozzle assembly vastly improves nozzle life expectancy.

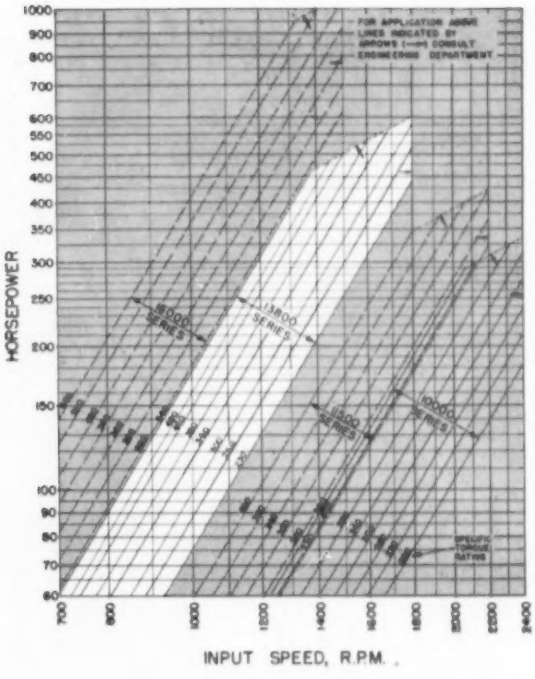


PUROLATOR

"FIRST IN THE FIELD OF FILTERING"

PUROLATOR PRODUCTS, INC., Rahway, New Jersey





ENGINE APPLICATIONS		
Eng. Mfg.—Model	Eng. Mfg.—Model	Eng. Mfg.—Model
Allis-Chalmers PC1879	Climax V-330	Mercedes-Benz MGB36 BG
Allis-Chalmers DC1879	Climax V-85	MGD V8S
Allis-Chalmers DSC 1879	Cummins LVH	MGD V12
Allis-Chalmers PCS 1879	Cummins NVHS	Murphy Z4
Allis-Chalmers PC2505	Cummins VT-12	Murphy 120
Cat D-342	Deutz BA8M517	Murphy 327
Cat D-8	Fairbanks 38FS 1/4	Penman V8FP95L
Cat D-364	Gardner 6-L3	Sawer —
Cat D-9	Hall Scott V-12	Sterling V-D6
Cat D-375	LeRoi H-1500	Waukesha RKO
Cat D-387	LeRoi H-700	Waukesha RKH
Climax V-81	M.A.N. 5W9175/122 A	Waukesha RKOS
Climax V-285	M.A.N. 6W9 175/122 A	Waukesha LKO
	Mercedes-Benz MB836 B	

ANNOUNCING . . . the new Twin Disc 13,800 Series Three-Stage Torque Converter

By W. B. Gibson, Sales Manager
Hydraulic Division, Twin Disc Clutch Company, Rockford, Illinois

With announcement of the new 13,800 Series, the Twin Disc Clutch Company *now* provides a three-stage torque converter for every horsepower range from 40 to 1,000—offering four distinct sizes, with a total of twenty-nine capacities, through internal blading variations.

Designed specifically to accommodate a large number of engines for which previous models were not ideally suited (see listing above)—this new series is planned around a *simple basic unit*—with easy-to-add components which produce ten specific models. This arrangement permits extreme flexibility and speedy interchange of components to provide a model specifically adapted to a wide variety of applications.

The 13,800 Series provides two *output* arrangements. There is *one standard output shaft assembly* designed for maximum side pull loads up to the full capacity of the converter. On this particular output shaft assembly, an output governor take-off is available. There is also *one standard output flange* designed for universal joint or flexible gear coupling drive.

There are also three *input* arrangements—spider drive, incorporating a rubber block drive — which withstands normal misalignment conditions without imposing undue loads or stresses on the input shaft or the engine crankshaft; clutch assembly and independent mounting. In addition to being offered in ten different models, this new torque converter can be adapted, with appropriate engine speeds, to all engines in the 60 to 600 horsepower range by internal blading variations.

Get all the facts on the advantages of torque converter drive in equipment that *you're* planning or designing. Write *now*, to the Hydraulic Division, Rockford, Illinois.

Twin Disc Clutch Company
Racine, Wisconsin
Hydraulic Division, Rockford, Illinois

AEROQUIP HOSE LINES . . . as near as your telephone in 125 industrial areas

Flexible Hose Lines with reusable Fittings

Self-Sealing Couplings

The solution to your industrial plumbing problems is as near as your telephone. The man to call is the Aeroquip distributor serving your locality. His thorough experience with all types of industrial fluid systems fully qualifies him to be of assistance to you. He stocks a complete supply of Aeroquip Hose, Detachable and Reusable Fittings, and Self-Sealing Couplings. He can show you how to save time and expense by making your own Aeroquip Hose Assemblies from bulk stock. If you are in or near one of the cities listed, you'll find your Aeroquip distributor's name in the Yellow Pages of your telephone directory under the Aeroquip Trademark in the hose classification.

ALABAMA—Birmingham
Montgomery
ARIZONA—Phoenix • Tucson
ARKANSAS—Little Rock
CALIFORNIA—Humboldt County
Imperial County • Long Beach
Los Angeles • Oakland
Sacramento • San Diego • San
Francisco • San Jose • Shasta
County
COLORADO—Denver
CONNECTICUT—Bridgeport
Hartford
DELAWARE—Wilmington
D. C., WASHINGTON
FLORIDA—Jacksonville • Miami
Orlando • Tampa
GEORGIA—Atlanta • Augusta
Macon • Savannah
ILLINOIS—Chicago • LaSalle
Oak Park • Peoria
INDIANA—Indianapolis
Evansville
IOWA—Dennison • Des Moines
KANSAS—Wichita
KENTUCKY—Louisville
Owensboro
LOUISIANA—Baton Rouge
New Orleans • Shreveport
MAINE—Portland
MARYLAND—Baltimore
MASSACHUSETTS—Boston
MICHIGAN—Detroit • Flint
Grand Rapids • Jackson
Kalamazoo • Lansing • Muskegon
Saginaw
MINNESOTA—Minneapolis
Duluth • St. Paul
MISSISSIPPI—Jackson • Natchez
MISSOURI—Kansas City
St. Louis
MONTANA—Billings
NEBRASKA—Omaha
NEVADA—Reno
NEW JERSEY—Camden
Newark
NEW YORK—Binghamton
Bronx • Brooklyn • Buffalo
Elmira • Manhattan • Queens
Rochester • Syracuse • Utica
NORTH CAROLINA—Greensboro
High Point • Raleigh
OHIO—Cincinnati • Cleveland
Columbus • Dayton • Findlay
Sandusky • Steubenville
Toledo • Zanesville
OKLAHOMA—Oklahoma City
Tulsa
OREGON—Portland
PENNSYLVANIA—Allentown
Delaware County • Easton • Erie
Harrisburg • Hazelton • Lancaster
Norristown • Philadelphia
Pittsburgh • Reading
SOUTH CAROLINA—Charleston
Sumter
SOUTH DAKOTA—Sioux Falls
TENNESSEE—Chattanooga
Nashville
TEXAS—Abilene • Beaumont
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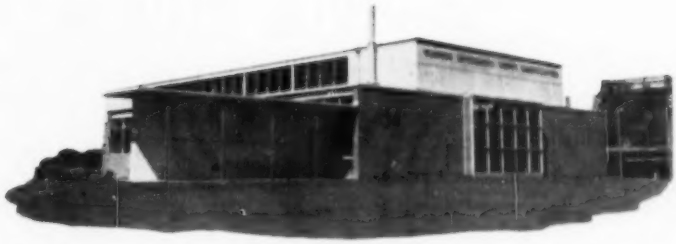
AEROQUIP CORPORATION, JACKSON, MICHIGAN

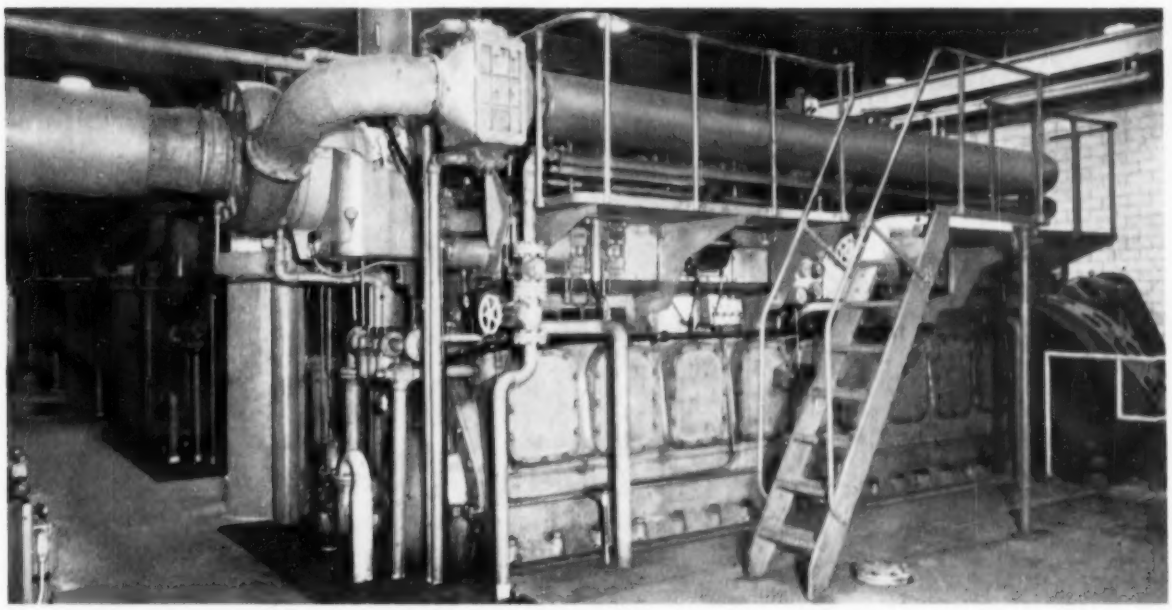
IN CANADA: AEROQUIP (CANADA) LTD., TORONTO 15, ONTARIO

LOCAL REPRESENTATIVES IN PRINCIPAL CITIES IN U.S.A. AND ABROAD • AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

The Agra Lite Cooperative near Benson, Minnesota houses five turbocharged Cooper-Bessemer Diesels, each rated 1850 hp at 327 rpm.



This view of Cooper-Bessemer Diesels at Benson shows after-coolers and exhaust-driven turbochargers. All five engines successfully use a No. 6 residual fuel oil.



How an "OIL CHANGE" saved $30,000 . . . in fueling Cooper-Bessemers

The ability of Cooper-Bessemer Diesels to run smoothly and effectively on either heavy fuel, light crude, or a combination of both, is but one of many reasons why so many Cooper-Bessemer units are being installed in cost-conscious plants throughout the country.

Here's an example . . . switching five 1850 hp Cooper-Bessemer Diesels from a higher priced lighter engine fuel to No. 6 residual fuel oil, the Agra Lite R.E.A. Cooperative near Benson, Minnesota effected a one year net saving of $29,769 . . . a remarkable 30% cost reduction.

And important to note is the fact that this "oil change" resulted in *no* increased wear on the smooth-operating turbocharged Cooper-Bessemers. In fact, the cleaning of valves, fuel pumps and nozzles periodically has shown these parts to be just as efficient, just as clean as when much lighter fuel was used.

Next time, why not check with Cooper-Bessemer for the ideal solution to *your* particular power problems.

MOUNT VERNON, OHIO

COOPER-BESSEMER

GROVE CITY, PENNA.

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DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

Commercial Filters Corporation acquires Honan-Crane and Michiana

Three famous names in filtration now united for greater service to industry...

A FILTER FOR
EVERY PURPOSE
Honan-Crane Oil Filters featuring a wide selection of interchangeable cartridges plus several types of bulk refill materials to provide "selective filtration" exactly suited to your requirements.
Fulflo Filters in all sizes for ultra-high flow rates with lowest pressure drop. Low-cost, long-lasting Honeycomb Filter Tubes give true depth filtration in a wide range of precision-controlled densities for any desired degree of micronic filtration.
Michiana Lube and Fuel Oil Filters for diesel and gas engine service. Available in a wide selection of types and sizes.

1. **Commercial FULFLO Filters and Honeycomb Filter Tubes** . . . the original controlled density element for full flow liquid filtration.
2. **HONAN-CRANE Filters** with bulk or cartridge filter elements, and **CFC** Pre-Coat Filters, Magnetic Separators, Coolant Clarifiers and Tubular Conveyors.
3. **MICHIANA Lube and Fuel Oil Filters** for diesel and gas engines.

The addition of Honan-Crane and Michiana enables Commercial to offer you the nation's most extensive line of filters for industrial use. Fulflo Filters and Honeycomb Filter Tubes will be manufactured exclusively at Commercial's modern plant in Melrose, Massachusetts. A newly-formed Lebanon, Indiana subsidiary—Indiana Commercial Filters Corporation—will be devoted to the production of Honan-Crane, Michiana and CFC equipment.

The expanded Commercial Filters organization represents a combined total of 70 years' experience in the industrial filtration field. This wealth of experience is available on any phase of your filtration program.

DISTRICT OFFICES—
New York • Chicago • Memphis
Sales and Service Representatives in more than 30 principal cities

COMMERCIAL FILTERS CORPORATION

plants at:
Melrose, Massachusetts
and Lebanon, Indiana

"This piston tells the story of better lubrication with GULF DIESELMOTIVE OIL,"

says Mr. Oscar Voight, Chief Engineer of Baker-Whitely Towing Co., Baltimore, Md.

"I'VE never seen anything like Gulf Dieselmotive Oil for tugboat engine lubrication," says Mr. Voight. "When we pulled the pistons of the 'Columbia' after nine years of continuous service, they were barely worn. Rings were free and ports not clogged. Those pistons still had plenty of service left in them."

Gulf Dieselmotive Oil has proved time and again in scores of tug fleets that it has the quality to stand up and provide more effective protection for the powerful engines of these hard working boats.

Here's why:

1 Chosen for their ability to prevent hard carbon deposits in hot spots, the selected base stocks of Dieselmotive Oil also provide an oxidation resistance safety factor.

2 100% solvent refining of base stocks (which removes undesirable constituents) guarantees greater stability and more effective bearing protection.

3 Superior additive response is obtained by carefully matching the additives to the base stocks. This insures clean rings, grooves, oil cooling passages, and a minimum of piston crown deposits.

This combination of Dieselmotive qualities makes possible more hours of operation between ring jobs, and lower maintenance costs. Ask a Gulf Sales Engineer—experienced in Diesel engine operation—to recommend the proper grade of this outstanding lubricating oil for your Diesels. Contact him at your nearest Gulf office or write to Gulf Oil Corporation · Gulf Refining Company, 1822 Gulf Building, Pittsburgh 30, Pa.

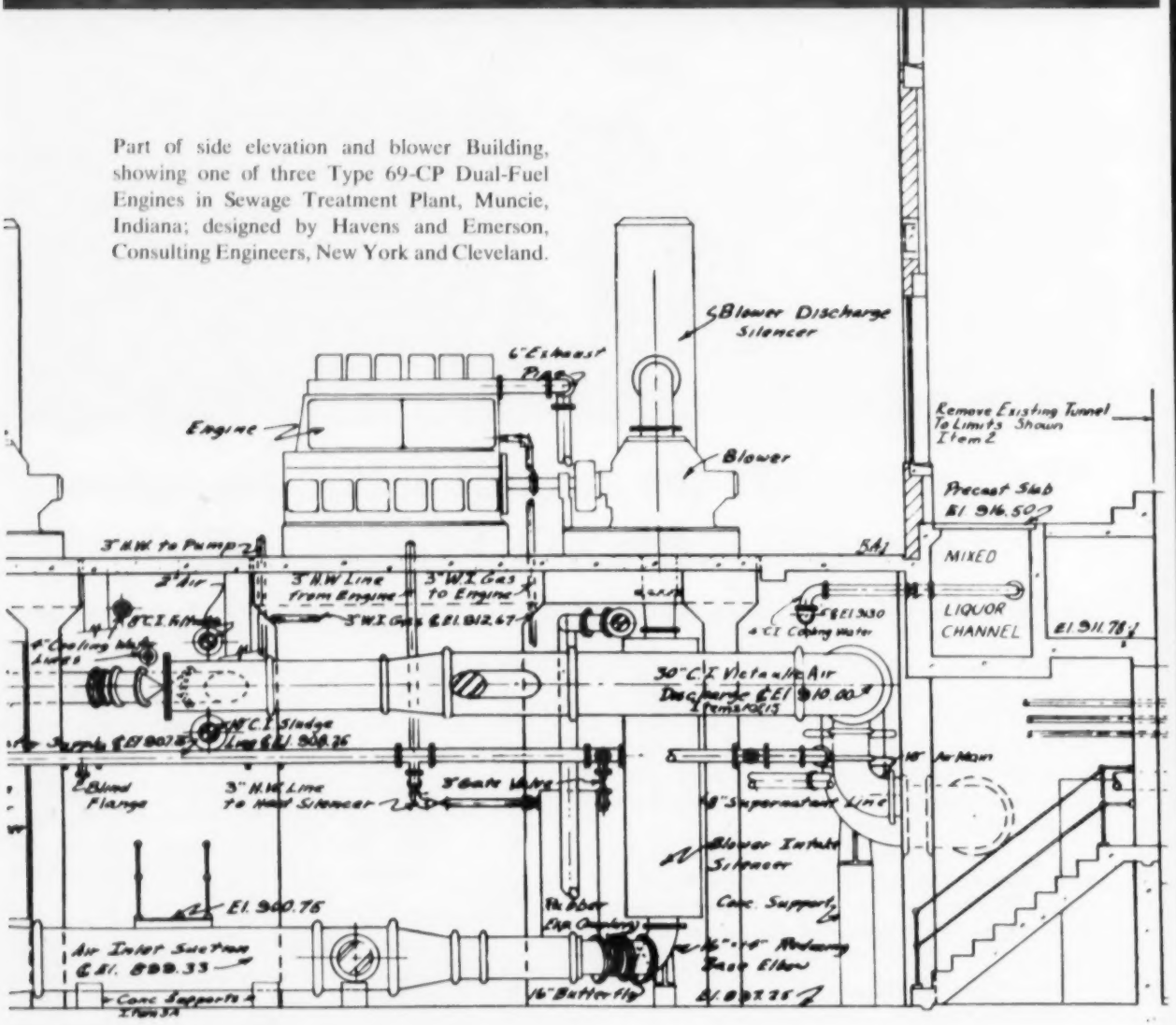
GULF

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

MUNCIE, INDIANA

selects 3 CP Dual-Fuel Engines

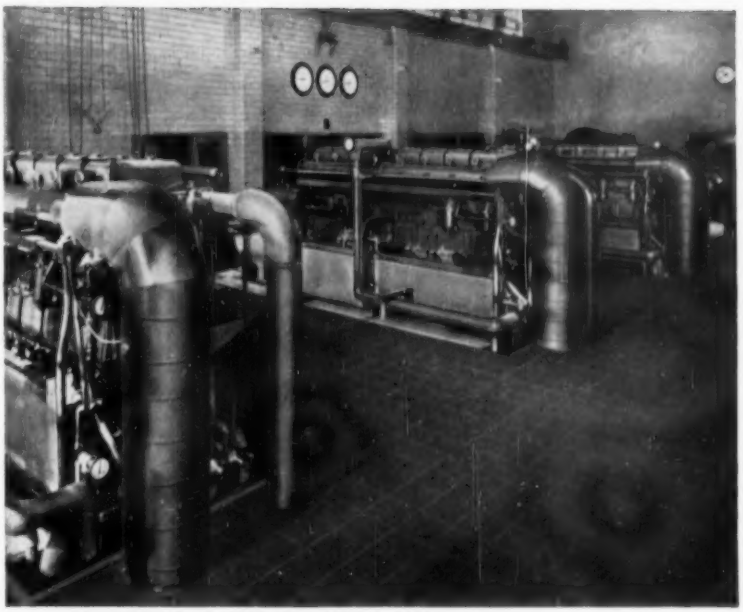
Part of side elevation and blower Building, showing one of three Type 69-CP Dual-Fuel Engines in Sewage Treatment Plant, Muncie, Indiana; designed by Havens and Emerson, Consulting Engineers, New York and Cleveland.



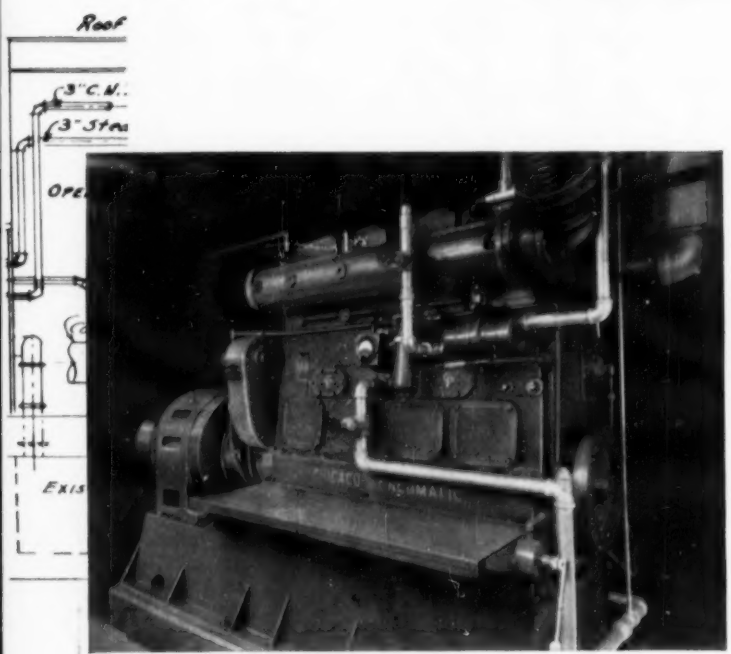
for sewage treatment plant

If you are planning a new sewage plant or contemplating an addition to existing facilities, it will pay you to consider Chicago Pneumatic diesel, dual-fuel, or gas engines for your power units for either generator or blower drives. Chicago Pneumatic engines are the power source of many sewage treatment plants now in operation. Your consulting engineer is familiar with the advantages of CP engines.

CP Engines . . . Diesel, Dual-Fuel and Gas Units . . . range from 120 to 1800 HP . . . in normally aspirated and supercharged models. For further information write *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*



Three 306 BHP, 600 RPM, Chicago Pneumatic Dual-Fuel Engines supply power for the Rockaway, L. I. Sewage Treatment Works.



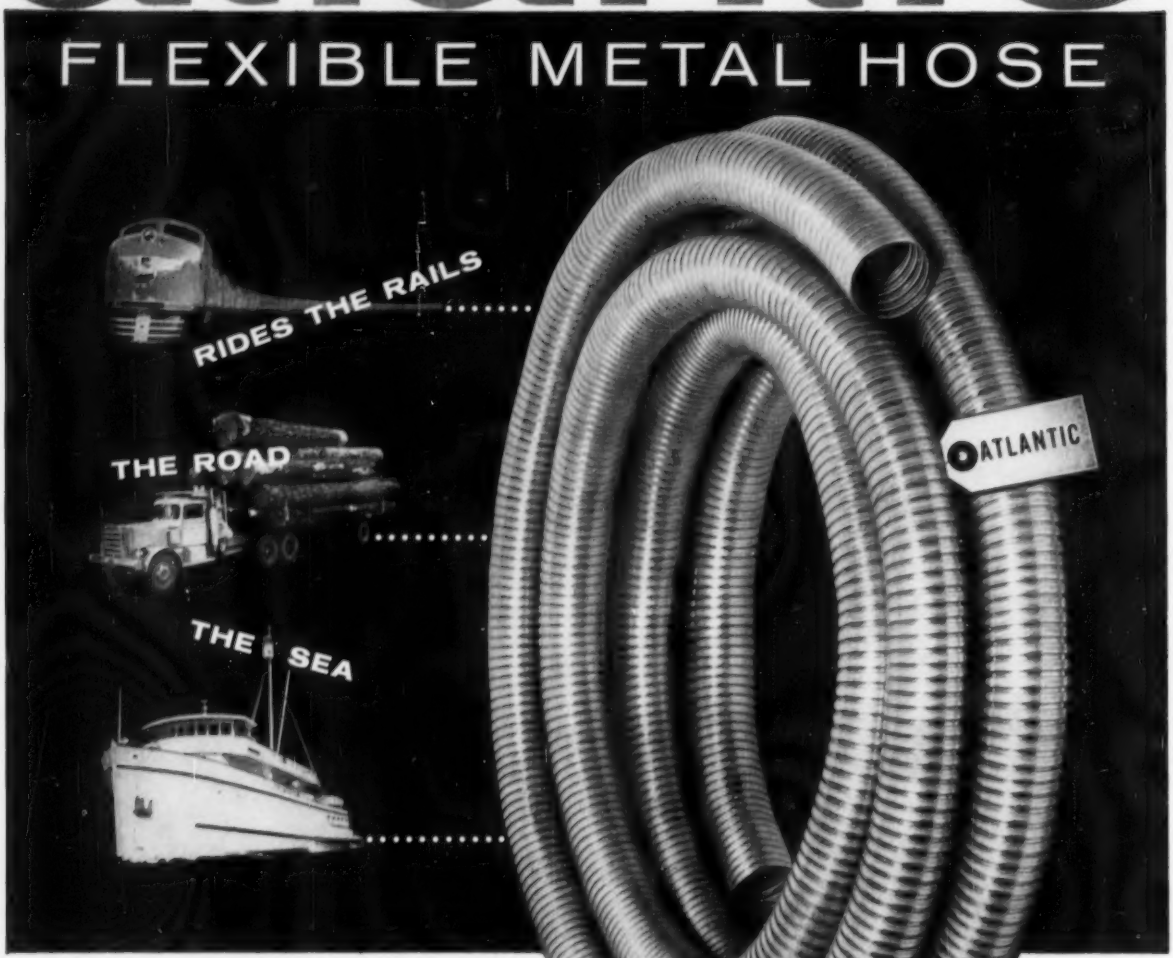
This CP Slow Speed Dual-Fuel Engine not only furnishes continuous power for the motors at Stratford's Sewage Treatment Plant, but as a standby unit it is on duty 24 hours a day — ready to operate pumps to lift untreated sewage above flood tide level and to prevent street flooding in the event of power line failure.

Chicago Pneumatic

PNEUMATIC TOOLS • AIR AND GAS COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS

atlantic

FLEXIBLE METAL HOSE



When diesels power trucks hauling 70,000 lb. loads of logs over mountain roads — or locomotives and ships, Atlantic flexible metal hose is usually given the job of guarding those vital diesel life lines—water, fuel, exhaust.

Atlantic flexible metal hose is manufactured to tough specifications.

Wall thickness is absolutely uniform. Tight against water, oil, steam, gas and air. Requires no maintenance. Atlantic flexible metal hose dampens vibration, remains flexible at higher temperatures.

There is an Atlantic flexible metal hose for each of these applications. Made in bronze, steel, stainless and monel—⅛"-36" I.D. with required fittings.

For misalignment and vibration

JOB TESTED CERTIFIED

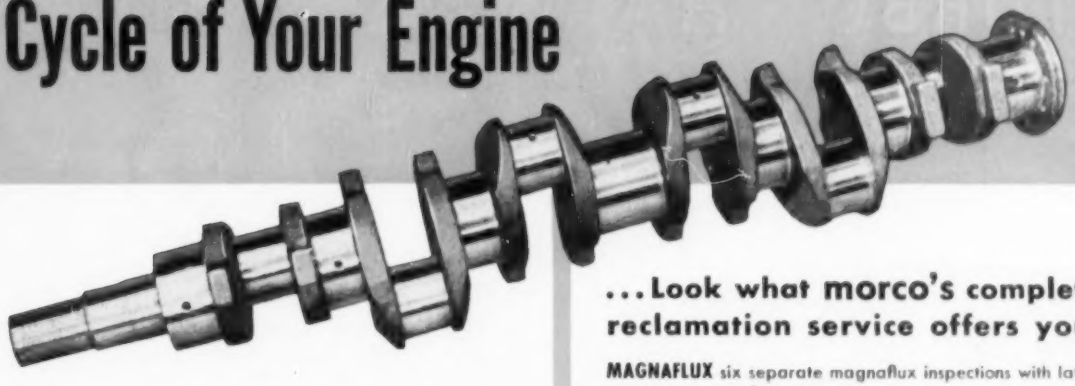
Write for Diesel Bulletins 1020 & 50A. See our Catalog in Sweet's Product Design File.

ATLANTIC METAL HOSE CO., INC.

309 DYCKMAN ST., NEW YORK 34, N. Y.

...NOW

with morco Factory-Certified Exchange Crankshafts You Can Count on Trouble-Free Operation for the Full Life Cycle of Your Engine



morco's factory methods turn out like-new crankshafts reconditioned to standard undersizes at a fraction of the cost of a new crankshaft. MORCO dealers—coast to coast—are stocked with a supply of reconditioned shafts for different diesel engine models. Users of Detroit Diesel and Cummins engines can exchange worn shafts for MORCO reconditioned shafts through authorized dealers. You get immediate service, guaranteed quality and terrific economy.

Why take chances? There is no substitute for factory parts and methods. Let your Engine dealer be your source for dependable, safe crankshaft regrinding. Let him help you get the most out of your operating dollar with MORCO Exchange Crankshafts.

*TOCCO is a registered trademark of The Ohio Crankshaft Co.

...Look what morco's complete reclamation service offers you!

MAGNAFLUX six separate magnaflux inspections with latest equipment.

GROUND on production type equipment to engine manufacturers' specifications. Original stroke retained.

TOCCO* HARDENED by the original equipment method when necessary.

ROLLED FILLETS increase strength at the most critical areas.

DYNAMIC BALANCE restored on original factory balancing equipment.

THRUST COLLARS and surfaces restored.

GEAR FITS renewed. **OIL SEAL** surfaces renewed.

KEY WAYS restored. **THREADS** repaired.

DOWEL HOLES repaired.

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Mail Coupon Today!

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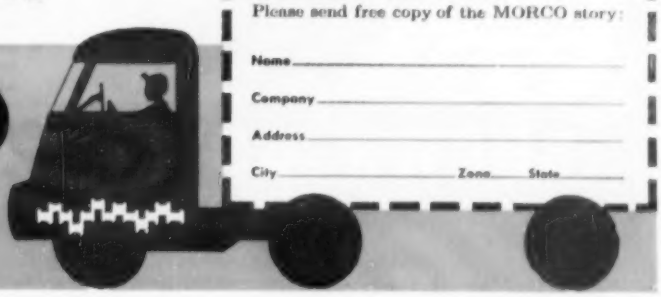


Steadystate Flow -vs- Blowdown

TURBO-CHARGING SYSTEMS

BOTH turbocharging methods have decided advantages for specific applications.

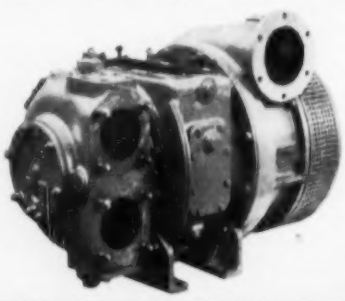
The *Blowdown System* is strictly dependent on the available exhaust pipe volume but permits reaching the required energy necessary to scavenge and to supercharge the engine at lower scavenge pressure. The *Steadyflow System,* though requiring higher scavenge pressures, has the advantage of being applied independently from the turbocharger position in the engine room.

Whichever method is required, Brown Boveri has the engineering and design knowledge as well as the manufacturing "know-how" to supply turbo-chargers which get the MOST *from either system.*

If you have a turbocharging problem, it will pay you to contact BROWN BOVERI. Write for data.

BROWN BOVERI

BROWN BOVERI exhaust gas TURBO-CHARGERS give you ALL these advantages:



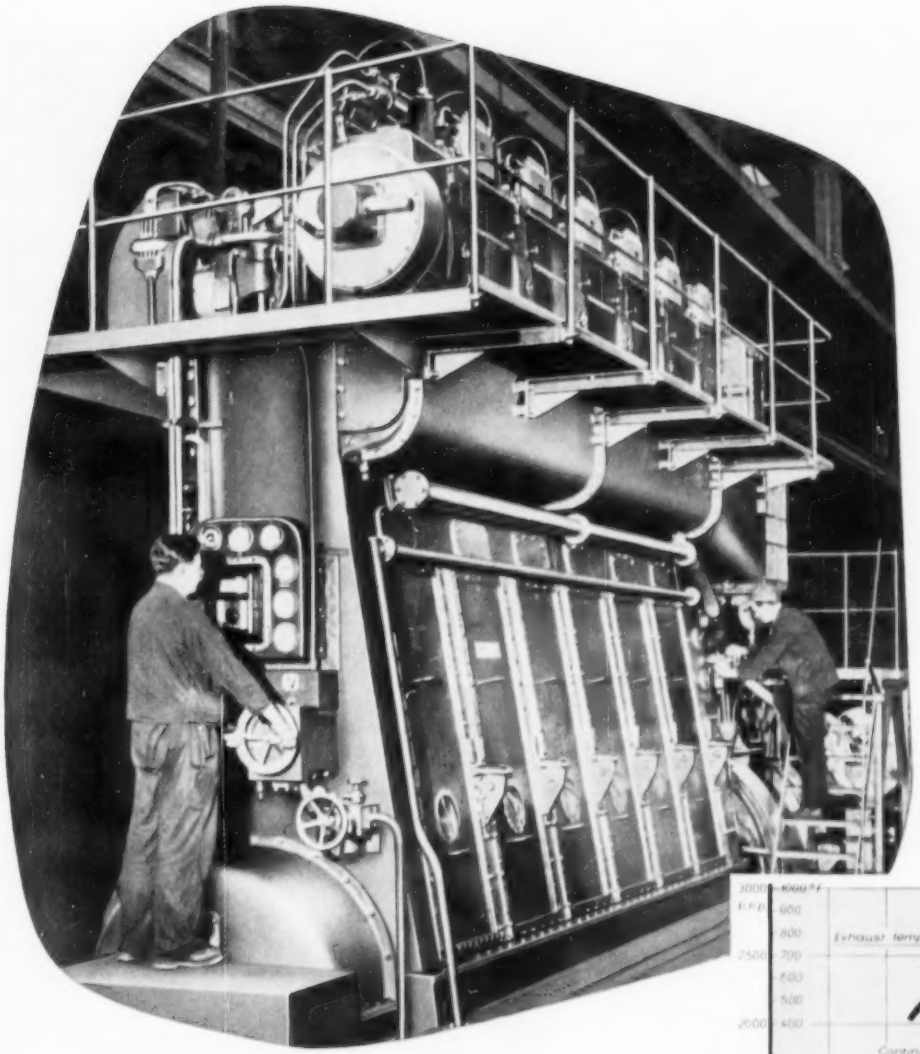
A typical Brown Boveri exhaust gas Turbo-Charger. These are available in various sizes for charged outputs from about 100 BHP to 6,000 BHP, 4- or 2-cycle operation.

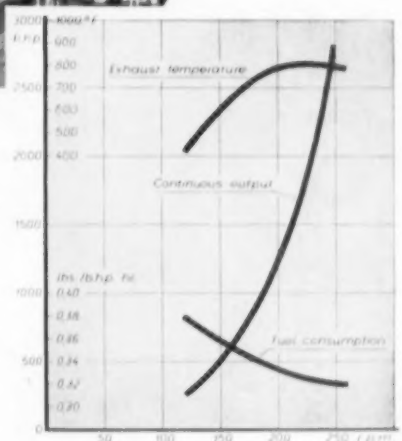
- Continuous power increases of 100% or more.
- No increase in operating costs since chargers run on exhaust gases from turbines.
- 40% and more reduction in space and weight per HP of supercharged engine.
- Self-contained lubricating system eliminates special oil piping outside the engine.
- Air pressure equalization prevents polution of blower wheel and bearings.
- Ideal for use at high altitudes, too, since pressures can be increased to that of sea level operation.
- Only Brown Boveri offers engineering design and application assistance of internationally recognized specialists in turbo-chargers.

BROWN BOVERI CORPORATION

19 RECTOR STREET • NEW YORK 6, N. Y.

Atlanta, Ga. • Birmingham, Ala. • Boston, Mass. • Butte, Mont. • Chicago, Ill. • Cleveland, O. • Denver, Colo. Detroit, Mich. • High Point, N.C. • Jacksonville, Fla. • Kansas City, Mo. • Knoxville, Tenn. • Lewiston, Me. • Los Angeles, Cal. Minneapolis, Minn. • New Orleans, La. • New York, N. Y. • Portland, Ore. • San Francisco, Cal. • Seattle, Wash. • Tucson, Ariz.





High Supercharging and Operation on Heavy Fuel Oil

The engine type KV with high supercharging is designed for highest economy. It has an extraordinarily low fuel consumption. The crosshead design renders this engine particularly suitable for the combustion of heavy fuel oils. After long workshop tests this engine has proven its entire reliability in practical service as main propulsion engine for ships.

M·A·N

MARINE DIESEL ENGINE

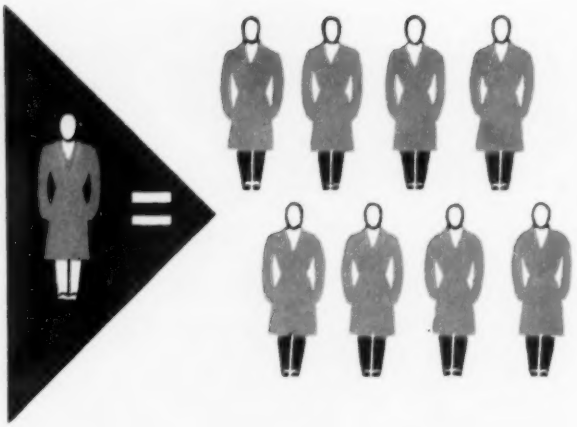
MASCHINENFABRIK AUGSBURG-NÜRNBERG AG. · WERK AUGSBURG

Represented in all countries

With

V-B Liquid Honing*

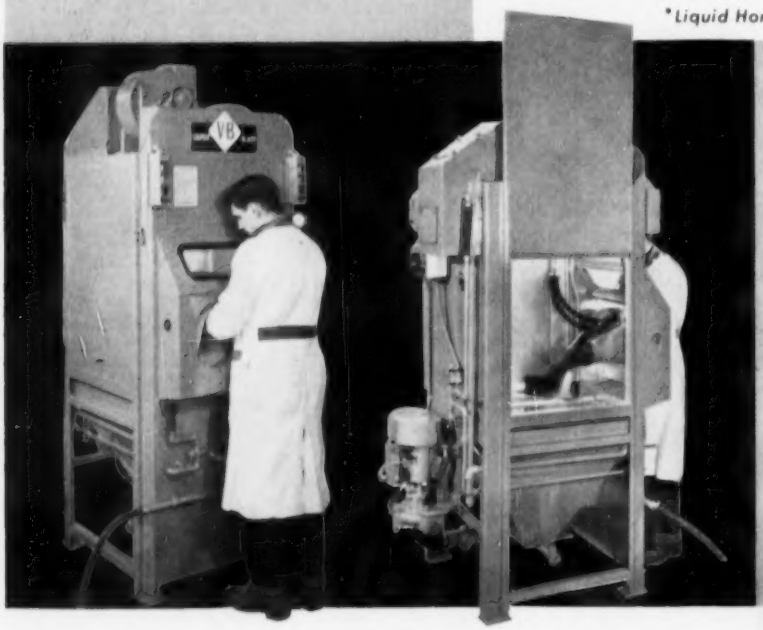
One Man Does Work of 8



Whatever *your* production problems — engine overhaul or surface conditioning of parts for O.E.M. — you'll find Liquid Honing paying for itself in a short time.

CONVENTIONAL methods prove slow and inefficient for deburring and cleaning the almost microscopic holes in this Diesel fuel injector cup. But Liquid Honing does the job *eight times as fast* — one man and one machine equaling the former production of eight men using another method. Best of all, Liquid Honing produces a smooth surface that promotes better fuel flow and cuts down gum and carbon deposits.

*Liquid Honing and Vapor Blast are trademarks.



to learn the whole story . . .

Send one of your parts for a processing demonstration and complete engineering report on the possibilities of Liquid Honing in your plant. No obligation.

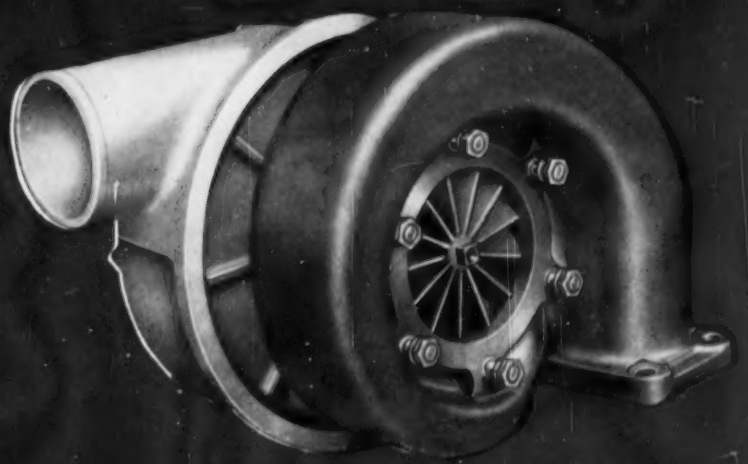
VAPOR V-B BLAST
MILWAUKEE, WISCONSIN

DOLLAR FOR DOLLAR, JOB FOR JOB, NO OTHER SURFACE-CONDITIONING METHOD CAN EQUAL VAPOR BLAST LIQUID HONING

VAPOR BLAST MFG. CO.
3005 WEST ATKINSON AVENUE
MILWAUKEE 16, WISCONSIN

SCHWITZER

TURBOCHARGERS



"ORBIT-SEEKING," "INSTANT-ACTION" WHEELS

These and other features exclusive in Schwitzer Turbochargers, account for proven installed performance and durability.

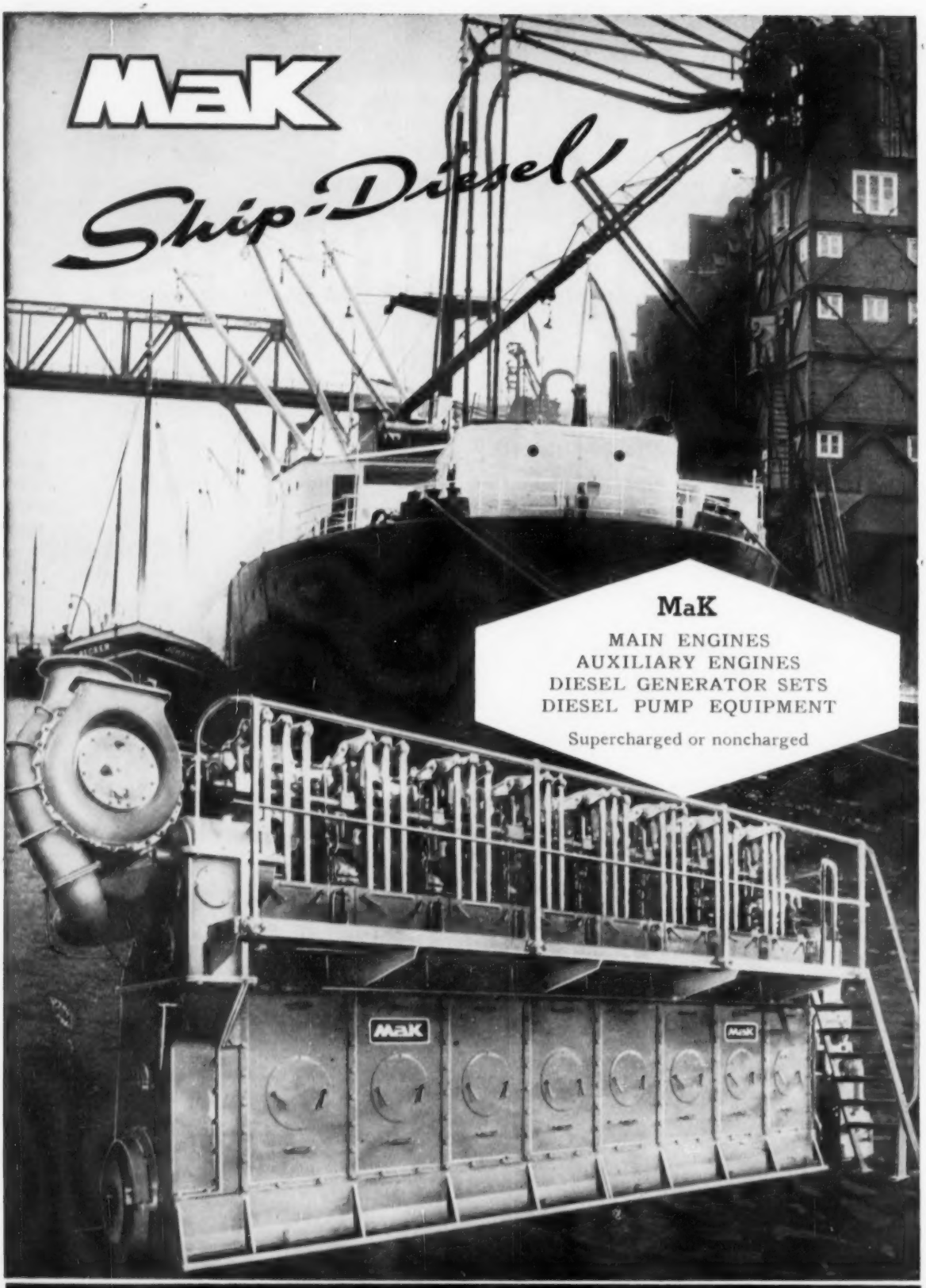
"Orbit Seeking" Wheels, as pioneered in Schwitzer Turbochargers, are now being featured in the Turbine Engine Industry.

"Instant Action" wheels assure rapid compressor acceleration for the best installed engine performance.

As your supplier, Schwitzer assures you of the most advanced design and economy in the field of fluid flow and vibration damping products.

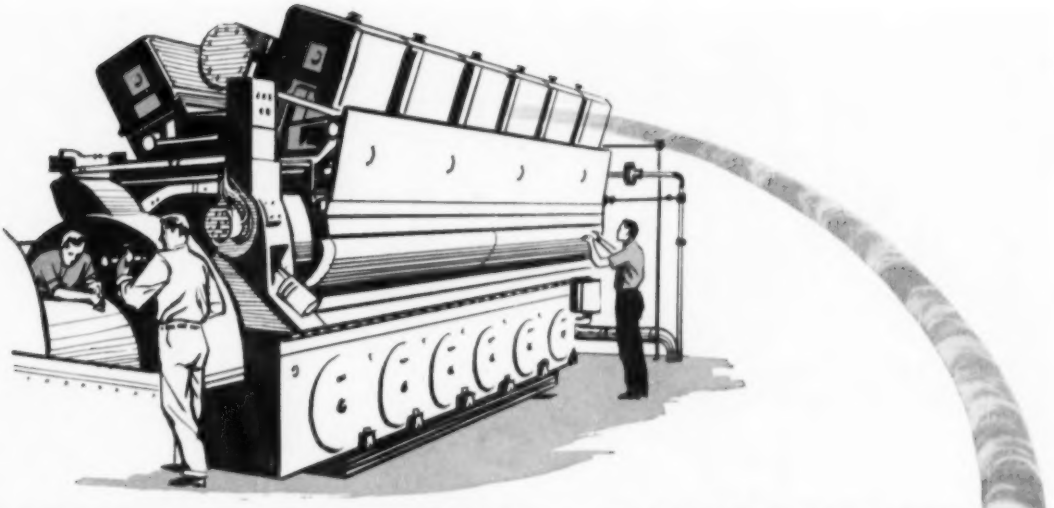
SCHWITZER CORPORATION

INDIANAPOLIS, INDIANA



MASCHINENBAU KIEL AKTIENGESELLSCHAFT

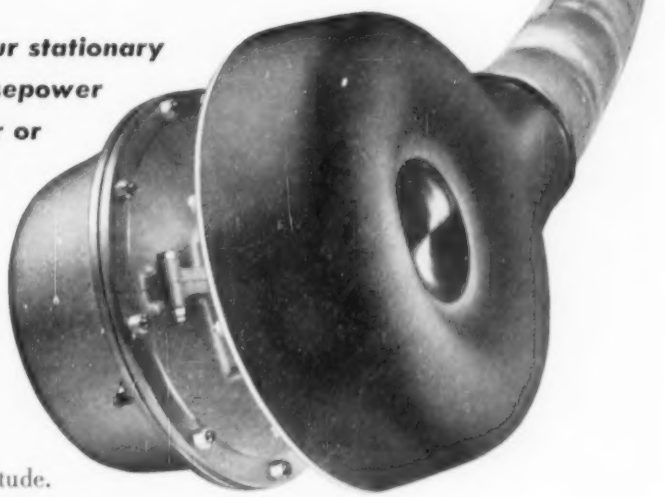
GERMANY



BOOST DIESEL OUTPUT

with less fuel...less noise...less smoke

AiResearch Turbochargers give your stationary or mobile diesels more added horsepower than any comparable turbocharger or supercharger installation!



The application of AiResearch Turbochargers to stationary diesel equipment will overcome excessive noise and smoke problems... jump horsepower to a much higher level... and cut your fuel bills on a horsepower per hour basis.

In addition, it will restore operating efficiency for your diesel power plants at altitude.

Application of these finely engineered power packages to mobile diesel equipment is equally effective... as has already been demonstrated in the remarkable results achieved by the installation of AiResearch Turbochargers on Caterpillar diesel machinery.

AiResearch is the largest producer of small turbomachinery in the United States, with twenty-five *million* hours of experience. This unmatched experience explains why AiResearch Turbochargers lead in power, economy and dependability. Your inquiries are invited.

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND RELATED MACHINERY

TWINSURANCE

FOR ALL DIESELS

FRAM WATER SEPARATOR AND FUEL FILTER REMOVES ALL WATER—TRAPS DIRT AND DUST!

A FRAM Water Separator and Fuel Filter will give your fuel injectors complete protection by:

1. Removing *all* water to save injectors from pitting and corrosion!
2. Trapping dangerous dirt to end abrasive action once and for all!

For longer life, less wear, fewer repairs—guard *each* diesel with a FRAM Water Separator and Fuel Filter! For complete details write to: FRAM CORPORATION, Providence 16, R.I. or to Fram Canada Ltd., Stratford, Ontario.

FRAM
OIL • AIR • FUEL • WATER
FILTERS

Dart 140-TC truck with Allis-Chalmers 8DAS-1125 supercharged diesel being loaded by a shovel powered by an Allis-Chalmers 6DCS-1879 supercharged diesel.

Fifty-five ton Dart truck powered by Allis-Chalmers 8DAS-1125 supercharged diesel dumping over edge of spoil bank that is approximately 500 ft high.

DIESEL ENGINES AVERAGE 5,000 HOURS BEFORE OVERHAULS

Allis-Chalmers Buda Division truck engines powering 24 Dart and Euclid trucks help keep production flowing smoothly at the Bagdad Copper Corp. mine under extremely demanding conditions. These trucks work two shifts a day, six days a week, hauling out both overburden and ore. The haul covers about 7/10 mile, up a grade which starts at 12 percent and quickly increases to 18 percent, with five torturous switchback turns. Thick, abrasive dust adds still further to the grueling test.

Under these conditions the Allis-Chalmers engines have averaged over 5,000 hours of operation before their first overhaul. Many of them have given more than 20,000 hours of service since 1949, and are still "going strong."

Other Allis-Chalmers engines also take a hand in production even before the hauling stage. A large shovel powered by a Model 6DCS-1879 engine has loaded out more than seven million tons of ore since June, 1949. There are Allis-Chalmers engines on the drills, compressors and dozers.

Altogether, the performance of these big, tough engines has helped hold the over-all cost of moving ore and overburden to less than ten cents a ton. It will pay you to put productive performance like this under the hood of your trucks and other units. Write for complete details and the name of your nearest Buda Division dealer.

ALLIS-CHALMERS, BUDA DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS AC

BC-1

Trucks at the Bagdad Copper Corp. mine, Bagdad, Arizona, haul overburden and ore up grades as steep as 18 percent and around five torturous switchbacks — a real test for any hauling unit and its engine.

ALL PISTON RINGS ARE NOT ALIKE

Change to DaRoS Swedish iron rings and discover the Big difference . . .

DaRoS Piston Rings are *not* ordinary rings! Made of Swedish Charcoal Iron, they have a lower rate-of-wear than other rings. Wear on cylinders is less, too. That means less "down-time" for your equipment—thousands of more operating hours between ring renewals and cylinder reconditioning!

What's more, DaRoS Rings maintain complete efficiency in either new or worn cylinders—resulting in big fuel savings! You actually save 10% to 15% on fuel costs.

Discover the *big* difference DaRoS Piston Rings can make in your equipment. Just one installation will convince you. Write, wire or phone for recommended application and prices now.

(This is ad #10 in a series designed to tell Diesel Operators the important story about DaRoS Swedish Iron Piston Rings.)

DAROS

AMERICAN CORPORATION

D. D. Cook, President

8128 N. LAWNDALE AVENUE • SKOKIE (Chicago Suburb), ILLINOIS, U.S.A.

Distributors for North, Central and South America

The Engineer's Field Report

CASE HISTORY

LUBRICANT RPM Delo Oils

FIRM Del Este Water Company Modesto, Calif.

Engine powers pump for 28,000 hours—sleeve wear is less than 0.002 inch!

PUMPING UP TO 2200 GALLONS OF WATER PER MINUTE, a 165 h.p. natural gas fueled Waukesha engine ran 24 hours a day for more than three years in the Del Este Water Company plant at Modesto, California. Driving a turbine pump, it worked against a constant head, with speed controlled to maintain a set pump discharge pressure. In spite of this tough service, RPM DELO Special Lubricating Oil kept engine in perfect operating condition right up to time of inspection. Oil consumption actually was less for the last 8000 hours service than for the first 8000. Inspection showed sleeve wear only 0.001 to 0.0015" with no taper; crankshaft "miked" within factory standards. As shown above, rings and grooves are clean, sleeves unscored. Same sleeves and pistons were reinstalled and engine went back into pumping service.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

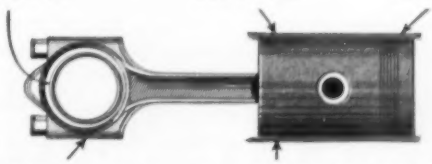
FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor, write or call any of the companies listed below.

Why RPM DELO Oils prolong engine life

Special compounds stop corrosion

Anti-oxidant resists lacquer formation

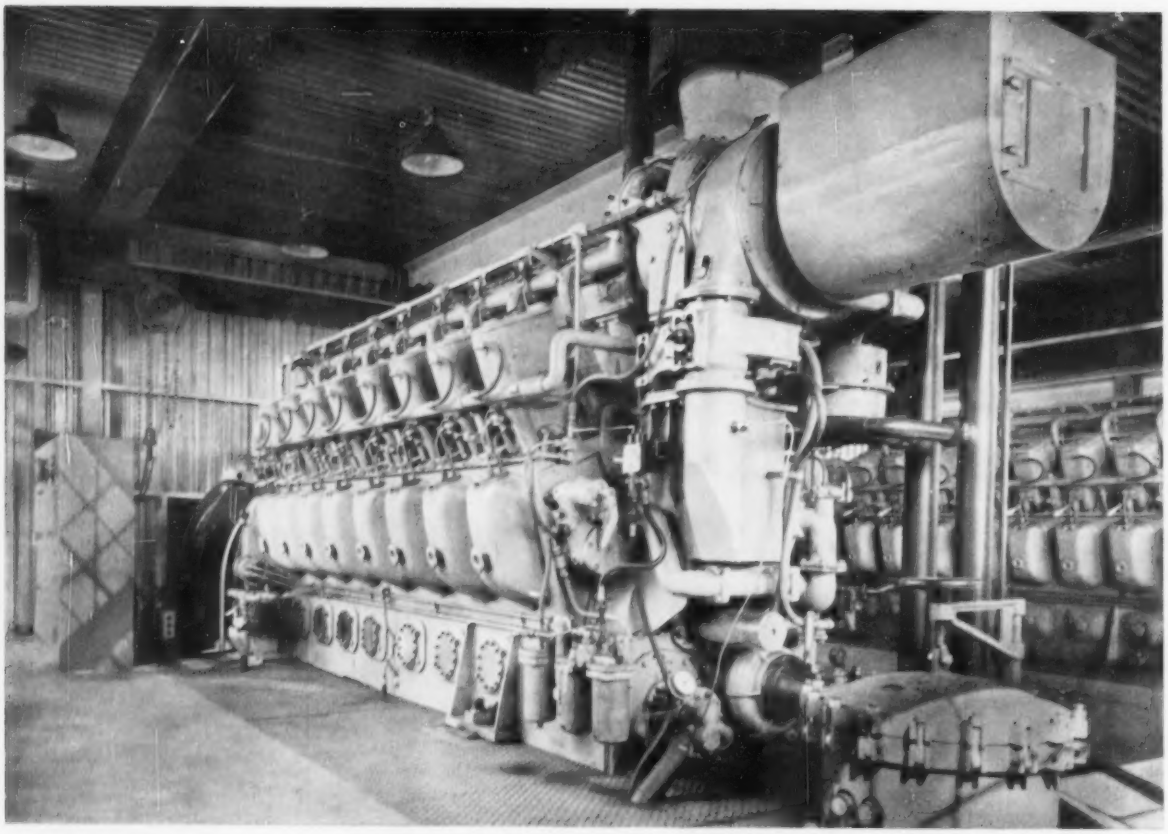
Detergent keeps parts clean



Inhibitor resists foaming

Metal-adhesion qualities keep oil on parts in running or idle engines

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado



One of two ALCO 251 Vee 16 diesels recently installed for pumping at the Laton Station of the Service Pipe Line Company.

ALCO 251 DIESEL SETS MODERN STANDARDS IN WEIGHT, POWER, ECONOMY

The ALCO 251 diesel brings modern standards of light weight, high power, high efficiency and increased economy to all stationary and marine applications. Ranging in horsepower from 550 to 2400, the 3 modern turbo-supercharged 251 diesels -- in-line six, Vee 12, and Vee 16 – all have interchangeable working parts. With a wide selection of standard modifications available, the engines are ideally suited to applications where the following advantages are desired:

Low Initial Cost — Standardized design, produced on assembly-line basis.

Low Installation Cost — Lower weight per horsepower, compact design, four-point mounting, and adaptability to "packaged" power applications.

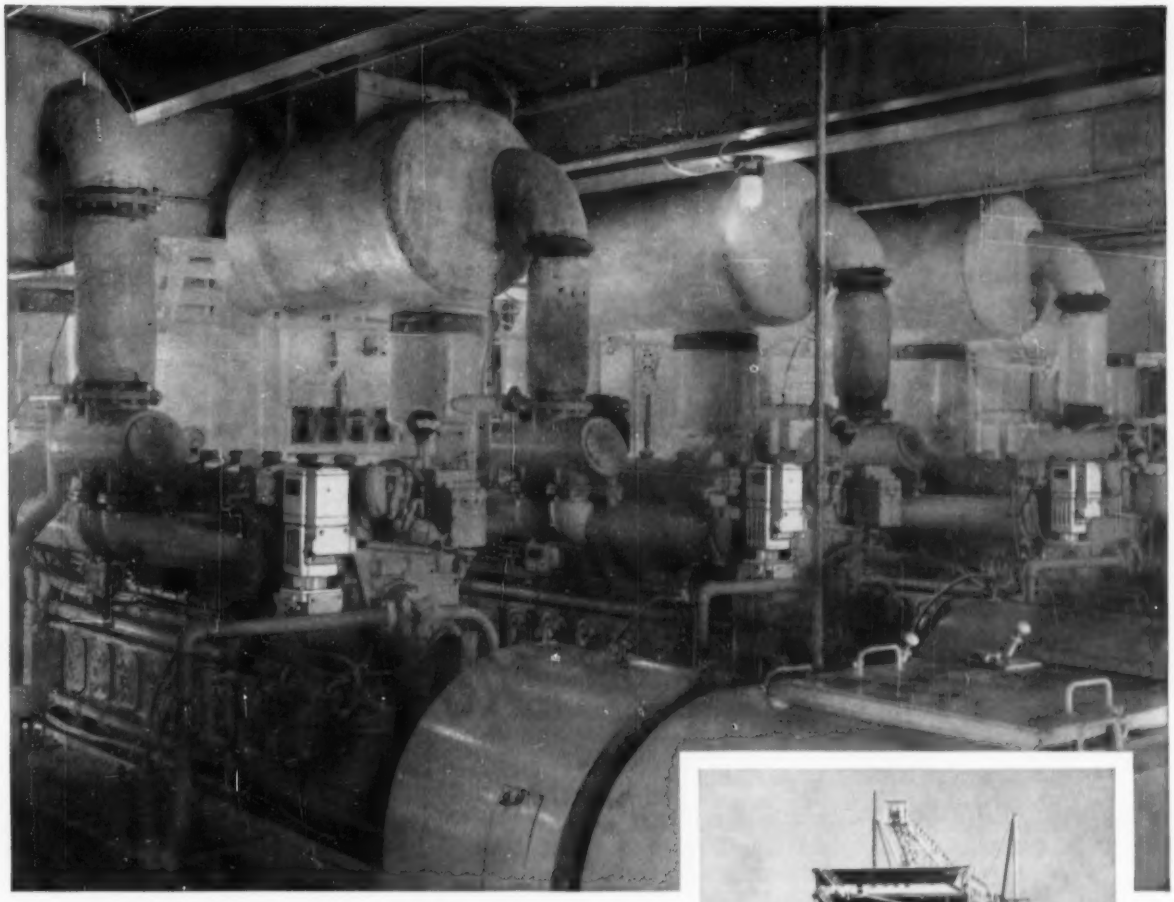
Low Operating Cost—Strong, rugged weldments, modern metallurgy, adaptability to remote or automatic operation, and readily available, low-cost replacement parts.

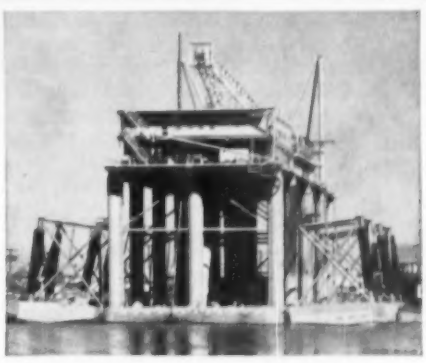
Complete Service Facilities — Seven regional warehouses, three repair and rebuild centers, experienced field-service engineering.

Contact your nearest ALCO sales office or write P. O. Box 1065, Schenectady 1, New York for information.

ALCO

ALCO PRODUCTS, INC.
NEW YORK
Sales Offices in Principal Cities





Marquette GOVERNORS

regulate diesel engines on submersible drilling barge

American Tidelands Barge "101" is designed to drill for oil and gas beneath the waters of the Gulf of Mexico.

After being towed to location, the barge is flooded with sea water and settles to the floor of the ocean, held in place by its own weight and by the stabilizing pontoons at each side. The two-story superstructure, supported on 52 ft. columns, houses the machinery, drilling equipment and crew.

The rig's main power comes from a battery of five GM Cleveland Diesels, regulated by Marquette Hydraulic Governors.

Massey GOVERNORS

Marquette GOVERNORS

Engineering facilities and service agencies for Massey and Marquette Governors are at your disposal for all problems of governing and control.

MARQUETTE METAL PRODUCTS DIVISION

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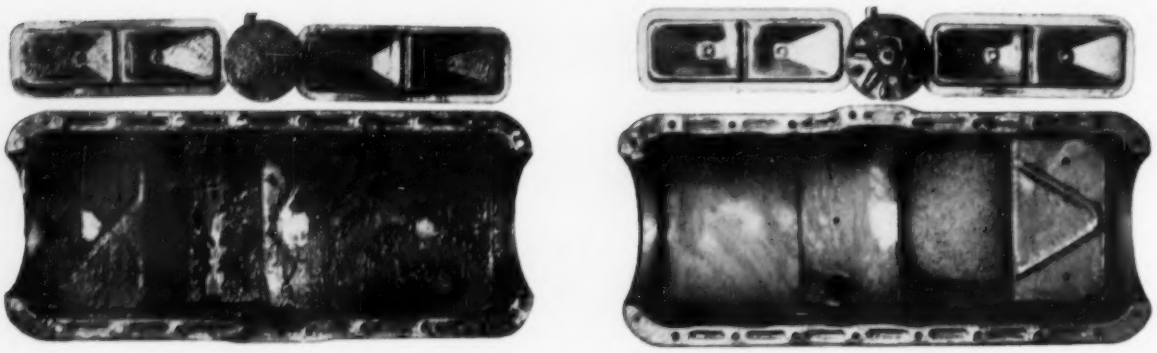
PROOF POSITIVE...

of SINCLAIR Diesel Oil Superiority!



This is actual photographic proof of the superiority of Sinclair Diesel Lubricants. On the left is a truck engine sump in which an ordinary oil was used. The clean sump on the right reflects conditions when a Sinclair Diesel Oil, SUPER TENOL, was used. This same top quality lubrication performance can be expected from all Sinclair Diesel Oils . . . *because Sinclair has the exact oil to match your engine's requirements!*

Sinclair RUBILENE® – These high viscosity index oils, refined by Sinclair's famed Phetone Process, have a long history of outstanding performance and are extensively used in stationary Diesel power plants today.

Sinclair RUBILENE HD – These high viscosity index oils contain additives which provide excellent detergent – dispersant properties, oxidation resistance, bearing corrosion prevention and anti-foam qualities. They are especially suitable for stationary Diesels as well as the higher speed Diesels used in industrial plants.

Sinclair GASCON® – These naturally detergent, straight mineral oils are recommended for slow, medium and high speed Diesels where carbon deposits, engine cleanliness and easy, low temperature starting is important.

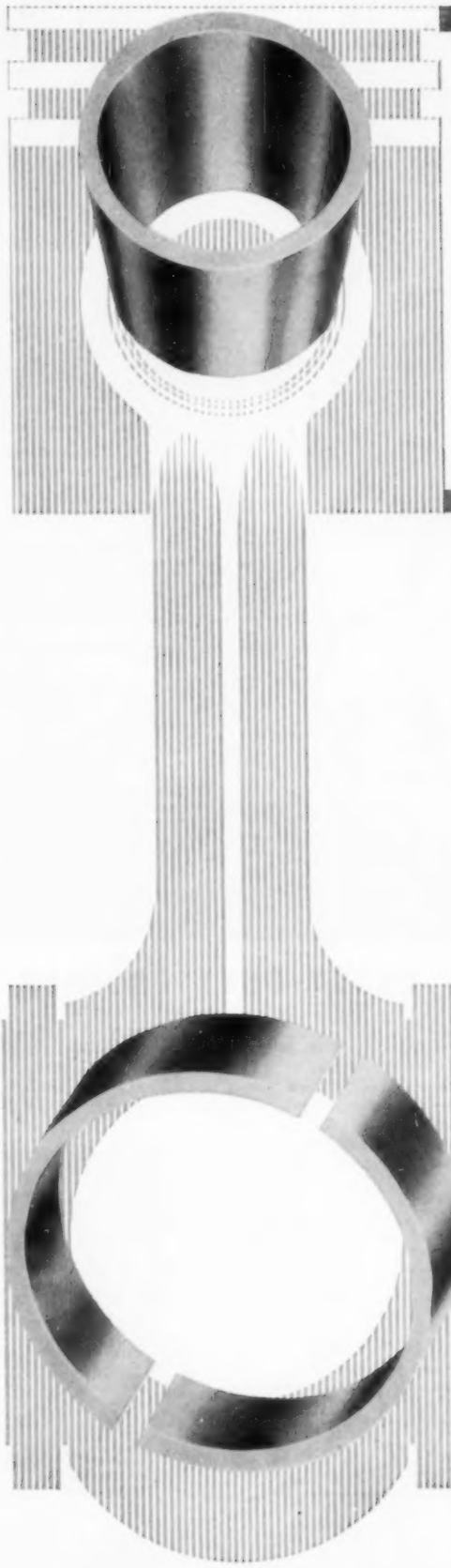
Sinclair GASCON HD – Heavy duty detergent type oils compounded with selected additives to provide extra detergent dispersant properties, bearing corrosion prevention, oxidation resistance and anti-foam characteristics.

Sinclair TENOL®, SUPER TENOL and TENOL EXTRA – A series of heavy duty, detergent – dispersant type, high viscosity index oils refined by the Sinclair Phetone Process. Recommended for all high speed automotive fleet Diesel engines, and for some engines of late design in stationary, portable and marine service. All three series contain varying degrees of additive concentrations necessary to give outstanding performance no matter what the service condition under which your Diesel operates.

For further information about Sinclair's trouble-proof Diesel lubricants, see your Sinclair Representative, or write Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

SINCLAIR

DIESEL OILS



To assure dependable diesel service, use dependable Johnson Bearings

The every-day work of the diesel engine demands the utmost in dependability. It has the responsibility of supplying electric power and light, of driving vital compressors, of maintaining railroad schedules, of propelling ships and trucks—all services upon which the economy of the nation depends.

Diesel manufacturers have accepted this responsibility and have designed their engines to give dependable service. One of the important components in these engines is the bearings—such as those made by Johnson Bronze Company. Engineers and production men alike at Johnson have a keen appreciation of the importance of their assignment. They realize that the engine bearings in the powerful diesels of today are subjected to forces of great magnitude, often at high speeds.

That is why the bearing specialists in the Product Engineering Department at Johnson Bronze work closely with diesel engine manufacturers in designing the proper bearing for each application. They recommend the most suitable bearing material—make sure it is adequate in size, strength and has correct clearance. The lubricating system is taken into consideration and provision made to resist effect of corrosive lubricants.

Johnson produces precision diesel engine bearings for the best in the industry. They may be cast bronze—bronze and babbitt—cast aluminum alloy—aluminum alloy on steel—steel and babbitt. Regardless of size or composition they have the necessary qualities to resist shock loads at high speeds—help the diesel maintain its reputation for dependable service.

To learn more about the services of the Johnson Product Engineering Department, write for a special bulletin. It may point the way to increasing the efficiency and dependability of your engines. Johnson Bronze Company, 470 S. Mill Street, New Castle, Pa.

Johnson Bearings

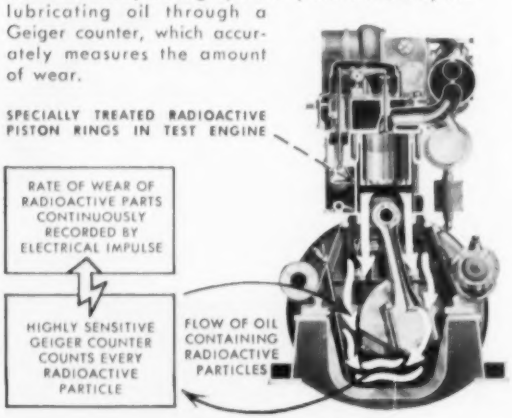
Putting atoms to work for longer engine life

ENTERPRISE BUILDS MORE DUTY INTO HEAVY-DUTY ENGINES

—Through radioactive testing and research

Discovering the secrets of engine wear — building more life into engine parts... these are challenges constantly put to the research staff at Enterprise laboratories. And today — thanks to the scientific application of radioactive testing — many of the mysteries of what happens inside an engine — of how and why parts wear, are being solved. Because of tests like these, new concepts have come to bear in diesel engineering — in metallurgy, piston design, operating speeds, types of fuel and lubricating oil, and many other phases. The results? More work from Enterprise Engines at less cost, with longer engine life than ever before. For the best in diesel, dual fuel, tri fuel and spark ignited gas engines, specify Enterprise — for 35 years the quality leader.

In Radioactive tests, engine parts such as piston rings are first irradiated in an atomic pile, then put in an Enterprise test engine. Any radioactive particles which are worn away during operation, are carried by the lubricating oil through a Geiger counter, which accurately measures the amount of wear.


SPECIALLY TREATED RADIOACTIVE PISTON RINGS IN TEST ENGINE
RATE OF WEAR OF RADIOACTIVE PARTS CONTINUOUSLY RECORDED BY ELECTRICAL IMPULSE
HIGHLY SENSITIVE GEIGER COUNTER COUNTS EVERY RADIOACTIVE PARTICLE
FLOW OF OIL CONTAINING RADIOACTIVE PARTICLES

Over a million horsepower at work the world over!

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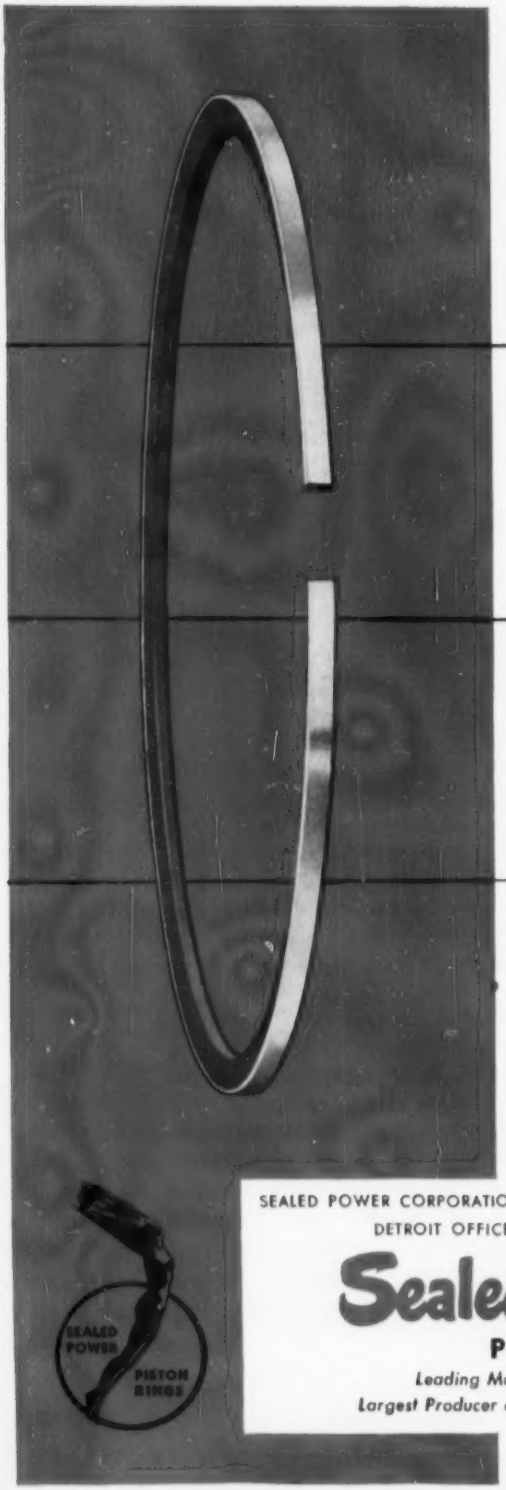
This Month — "Creativity"

Our subject overshot the space last month. We didn't get to discuss "creativity" so we'll pick up where we left off. At the ABP meeting we heard this term applied to editorial work, advertising, and particularly marketing. Once the meaning is understood it's not hard to translate it into terms of engineering, product improvement, maintenance techniques, or what have you? It might be defined as pioneering or just plain leadership in ideas. It's antithesis is "Me- Tooism". It's purpose is to create maximum impact at the point of sale of either a product or service. It is the sort of thinking that produces an idea like that of putting a small engine on a lawn mower, thereby creating a whole new market and selling several million engines. Or thinking up amortizing mortgages, making it possible for millions more people to own homes. Or promoting the "Do-It-Yourself" idea and selling millions of dollars worth of tools, materials and parts. In each case there is a definite incentive or appeal offered. You're nudging someone into parting with his loot and making him want to do it. Now we are back to "motivation". Obviously, there are as many different motivating factors as there are human emotions and needs. So creativity must be guided by motivation factors as they apply to your particular product or service. Many progressive companies have recognized all this. Note the growing number with "Market Analysis" departments, apart from the sales force. Call it what you may, an awareness of the principles is the first step. Then you need a setup for orderly collection and evaluation of facts gathered. It's a job for everyone. We're going to help too. We are in process of setting up an "Industry Board", selecting key people from among the different segments of our readership. We're going to bounce periodic questionnaires off this "sounding board" in a search for general and specific motivation data. Results will all be correlated and used in different ways. Some will appear in DIESEL POWER; some will be reports to selected portions of our industry; all will serve to guide our editorial policy. We think that this is an example of "creativity"; our "motivation"— better service to our industry.

B P E

SEALED POWER CYCLAN



overcomes 3 main causes of ring failure in Diesel engines!

HEAT

Cyclan retains tension under high operating temperatures.

BREAKAGE

Cyclan will not break in service.

EXCESSIVE SIDE WEAR

Cyclan's excellent bearing qualities prevent excessive groove wear often encountered with cast iron and steel.

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SEALED POWER CORPORATION • MUSKEGON, MICHIGAN • ST. JOHN'S, MICHIGAN • ROCHESTER, INDIANA
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Sealed Power Piston Rings

PISTONS • CYLINDER SLEEVES

Leading Manufacturer of Automotive and Industrial Piston Rings since 1911
Largest Producer of Sealing Rings for Automatic Transmissions and Power Steering Units

highlights

Waste heat recovery is next for one of the already efficient aluminum ore reduction plants using gas engines for power. Report is that exhaust gases will be funneled to 24 boilers for heat recovery. These, plus one gas-fired unit, will provide steam for turbo-electric power.

Caterpillar's new Glasgow, Scotland plant will soon have its ground-breaking ceremonies. It will produce crawler-tractors for Caterpillar Tractor Co., Ltd. of Great Britain.

Today's excavating equipment digs up link with the past in preparing for the future. When excavating the site for the army's Nuclear Package Power Reactor, Ft. Belvoir, Virginia, modern machinery dug up a petrified pre-ice-age stump. Experts said the stump could be more than 130 million years old.

Russian locomotive production, incorporated into the five-year plan of 1956-1960 calls for the building of 1630 new locomotives. This follows an assertion by Bulganin that Russia had been too slow in developing diesel locomotives, and serious measures would be taken to overcome the deficiency.

When 318 diesel-engine buses, purchased from the Mack Co., are delivered it will spell the end of public streetcars in New York City. 54 of the new air-ride buses will replace 40 trolley cars and the remainder will replace older equipment.

Diesel-powered US car was revealed at Brussels Motor Show for first time. Chrysler offered a 4-cyl diesel engine as first equipment on their Plymouth Belvedere, shipped overseas without an engine. Similar engine also to be available on US-made Chrysler Corp. Truck.

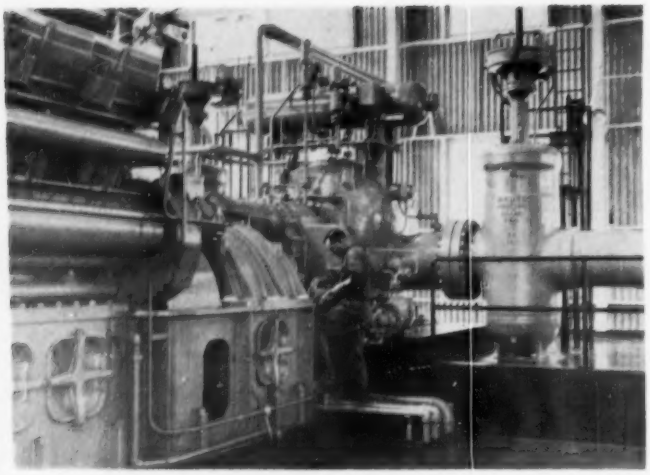
Air-cooled diesel engines powered 58% of all engine-powered exhibits at the Hanover (Germany) Fair, reflecting the European trend, according to Dr. Richard Kloss of Klockner-Humboldt-Deutz.

All 244 new locomotives installed in the first two months of 1956 by Class I railroads were diesel-electric units, announced the Association of American Railroads.

Transportation Management Program is offered this summer by Stanford University. Transportation executives from different areas will spend four weeks in study, discussion, and development of ideas for the years ahead. Registration date—April 20.

"Yard Doctor" makes calls at Pacific Intermountain Express Co. yards, bringing the shop to the trailer instead of the trailer to the mechanic. Small engine-powered mobile shop services trailers while they are standing, or even as they are being loaded. In addition to eliminating hauling equipment, it saves at least one man-hour per servicing.

Today's problems in the diesel field were discussed at a reunion of ex-diesel instructors, now in a broad range of commercial diesel activities. They are now employed as test engineers, repair shop owners, service and sales engineers, marine chief and port engineers, a shipyard supervisor, a college professor and a technical writer. Summary of principal sore spots included: shortage of competent diesel men and their laxity in up-grading themselves; confused parts picture due to frequent manufacturer revision; lack of knowledge in buying fuel and lube oils; and carelessness in fuel handling.



Nordberg 3000-hp engine-gear set driving into centrifugal compressor. Step-up gear is mounted on extension of the engine base. Close coupling makes overall length of the unit shorter.

Transco Station No. 23 on outskirts of Houston. Landscaped grounds, and hospital type mufflers and air-cleaners to minimize noise allow for future residential development of neighborhood.

Transco Installs Centrifugal Gas Compressor

Station No. 23 on Texas-New York gas pipe line uses a centrifugal compressor driven by an integral 3000-hp engine-gear unit.

THERE are a lot of "firsts" involved in Transcontinental Gas Pipe Line Corporation's Station No. 23. It boasts their first engine-driven centrifugal gas compressor (they have some steam-driven ones) and the unit went into service on the first of the year. Also, it is the first installation of Nordberg's Supairthermal spark-ignition engine. These units are built especially for such service and incorporate Nordberg's speed-increasing gear as an integral unit.

Station No. 23 was built by Transco in the outskirts of Houston on Steubner-Airline Road. Since this area will possibly be residential some day, they allowed in their planning for this contingency. Station grounds got a beauty treatment including the planting of St. Augustine grass for lawns. Exhaust noise being another possible public relations problem, special "hospital-type" mufflers were installed. Similar type air cleaners minimize intake air noise.

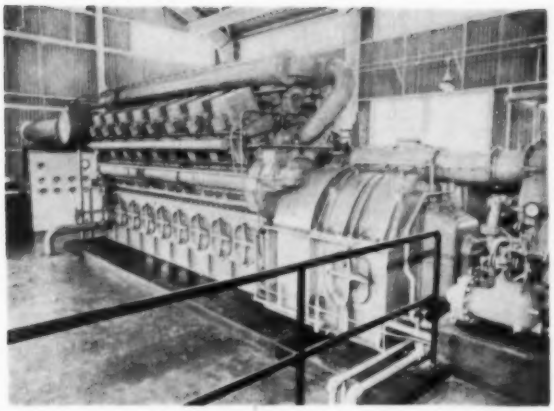
The 3000-hp engine-gear set consists of Nordberg's Supairthermal type FSE-1316-HSC spark-ignition engine and their double-pinion, double-bull gear speed increaser, both mounted on a common base. This unit was described in detail in the April, 1955, DIESEL POWER so only some highspots will be mentioned.

This vee-type engine is a 16-cyl model of a type built in 10, 12, 14 and 16-cyl executions. It has a 13-in bore and a 16½-in stroke. Since operation is on the Supairthermal principle, the expansion ratio is 12½:1. Reason for this terminology will be reviewed briefly.

A DeLaval high-pressure turbocharger supplies intake air at pressures up to 30 psig to an intercooler. The air is cooled to approximately 100°F. The high pressure differential between intake and exhaust manifolds provides both good scavenging and good combustion chamber cooling.

Closing of the inlet valve is variable through a mechanical linkage. Load is the controlling factor. Actually, turbocharger pressure, being a function of load, controls the linkage actuator. Action is to close the valve earlier as loads decrease.

When the valve closes early, expansion of the trapped air takes place during the remainder of the stroke. On the compression stroke, actual compression does not start until the piston reaches the same position it had when the inlet valve closed. The balance of the stroke is compression. The *net compression ratio* can be as low as 6:1. The air charge is considerably cooler and has more weight, so larger quantities of fuel can be burned completely with-



Center of vee-engine contains aftercooler, intake and exhaust manifolds. Turbocharger can be seen at rear. Window in camshaft cover (near nameplate) tells position of valve control mechanism.

out excessive heat load on the engine. Yet the expansion ratio of 12½:1 still remains to utilize a high percentage of the available energy.

This is the principle that produces the engine's high output with good efficiency. Regarding fuel efficiency of this gas engine, note that the variable inlet valve feature also has the effect of maintaining a favorable air-fuel ratio throughout the load range.

Rating in this application is 3000-hp at 470 rpm. It is applied to the 10:1 speed increaser through two gear-type flexible couplings and a quill shaft. The quill shaft arrangement provides torsional flexibility while still permitting close mounting of the gear to the engine. Alignment problems are eliminated as the whole unit mounts on an extension of the engine's bedplate, part of the latter forming the lower half of the gear housing.

Both bull gear and pinion bearings are in the upper half of the housing. Three bearings, one in the center, support the pinion. The pinion is a single forging and the bull gear is a weldment. Teeth are helically-cut, crowned, shaved and hardened. The gear is of the split herringbone type, eliminating lateral thrust. Pressure lubrication is supplied throughout.

A full-floating high-speed shaft, also using gear-type flexible couplings, connects the speed increaser to the centrifugal compressor. This is a single-stage DeLaval unit with a radial-type impeller. Inlet and discharge flanges are for 24-in pipe connections.

Operating at 4700 rpm, the pump has a design flow of 430 M°SCFD (million standard cu ft per day). Station design inlet pressure is 622 psig and the design discharge pressure is 702 psig.

The plan of operation calls for attended supervision during the day 8-hr shift. Two men are on duty. Full control and instrumentation of all vital functions is provided. Engine protection devices register on an annunciator that not only warns of a failure but indicates its cause.

Even during the remaining 16 hours of the day, the station is not completely on its own. Mainline pressure is telemetered from the compressor building to the switchboard for relay to the remote control panel in the Gas Control (Dispatching) Department of Transco's headquarters building in Houston. The engine can be stopped by the Houston dispatcher and by its own protective control devices.

Partial List of Equipment

Main Engine	Nordberg Mfg. Co.
Centrifugal Gas Compressor	DeLaval Steam Turbine Co.
Fast's high speed couplings	Koppers Co.
Fast's low speed couplings	Koppers Co.
Turbocharger	DeLaval Steam Turbine Co.
Pulse Generators	American Bosch Arma Corp.
Governor	Massey Machine Co.
Lube Oil Cooler	Kewanee-Ross Corp.
Automatic Shut-down Controls	Fulton-Sylphon Div.
Tachometer	Weston Co.
Pyrometer	Illinois Testing Lab.

What Do You Know!

Here are some questions to test your general knowledge of the diesel field. Make your selections, then turn to Page 124 to check them.

1. An intake air cleaner for use on a diesel engine should be efficient enough to remove dirt particles as small as:
   a. 1 to 5 microns.
   b. 5 to 10 microns.
   c. 10 to 15 microns.

2. Since dirt particles as small as 1 micron (0.00004-in) to 5 microns don't cause any excessive wear of engine parts, they don't necessarily have to be removed.
   a. True b. False

3. Of all the deposits found on diesel engine cylinder walls and in piston grooves, more than:
   a. 25% is dirt coming in with the intake air.
   b. 40% is dirt coming in with the intake air.
   c. 60% is dirt coming in with the intake air.

4. Much of the dust coming in with the intake air is of a silicate nature.
   a. True b. False

5. The horsepower output of commercial turbocharged engines over naturally aspirated engines of similar size and speed is:
   a. 50%.
   b. 75%.
   c. 100%.

6. Acceleration and smoke were problems encountered when automotive vehicular engines were first turbocharged because:
   a. Engine is overloaded during acceleration.
   b. Due to inertia, turbo speed lags change engine speed.
   c. Air-fuel ratio is low.

7. The "end-point" of a diesel fuel is a measure of which of the following characteristics?
   a. Ignitionability. c. Viscosity.
   b. Volatility. d. Carbon residue.

8. The higher the cetane index of a fuel, the greater the horsepower that can be expected from its use.
   a. True b. False

FWD model T-6414D transport-tractor featuring Deutz air-cooled engine. The mesh grille replaces radiator.

New FWD Truck has Air-Cooled Diesel

Deutz air-cooled vee-type diesel was adopted for a new-production trailer tractor. Some details of both truck and engine are given.

AN air-cooled diesel is now a standard engine in a new transport-tractor model. This is the model T-6414D, put into production by Four Wheel Drive Auto Co., Clintonville, Wis. Such installations are more common in Europe then here, due in part to a foreign trend toward air-cooling high-speed diesel engines. In this case, a German-built Deutz engine was selected.

The only outward indication of the air-cooled engine installation is that the hood was widened to accomodate the 90-deg vee-engine with its cooling ducts. On closer inspection you can note that the radiator is missing, being replaced by a screening wire mesh.

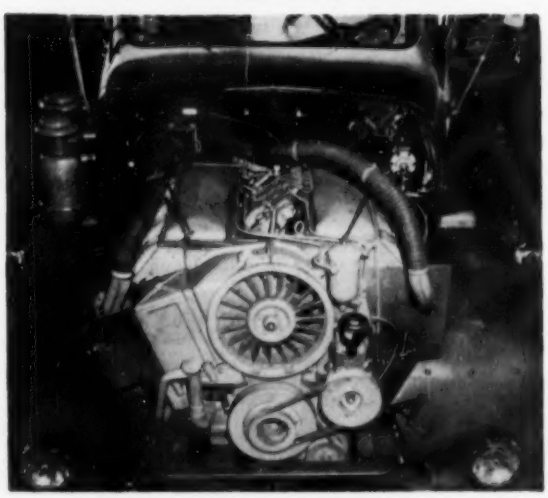
The six-wheeled vehicle, with four of the wheels transmitting drive, incorporates FWD's exclusive power-proportioning, fully-compensating center differential. This distributes power to front and rear driving wheels in proportion to load. Up to 37% greater tire economy is reported by elimination of the excessive wear normally resulting from turns. Weight on the axles is 6722-lb front and 5905-lb on the rear.

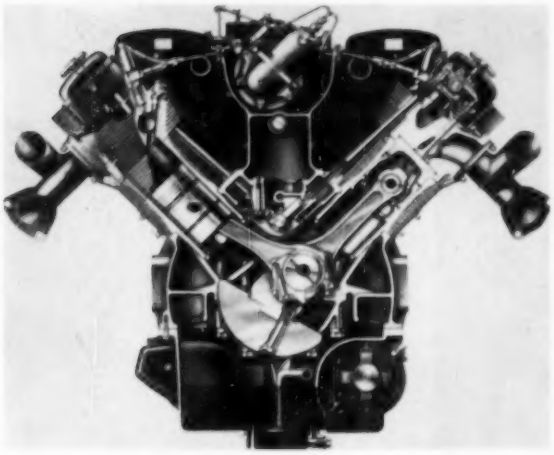
Utilization of front and rear drive allows better load distribution. This means better payloading. Also, four-wheel drive converts all weight into traction, a feature credited with giving greater driving control and safety even under adverse road conditions. Plus these truck design advantages FWD reports good operating economies and characteristics. For matching the engine to road requirements, a five-speed transmission is used.

The 8-cyl model F8L614 diesel engine was made by Klockner-Humboldt-Deutz of Cologne, Germany. U. S. distributor is the Diesel Energy Corp., New York. Engine is rated at 170-hp (including accessories) at 2300-rpm. A maximum of 447-lb torque is produced at 1200-rpm. Bore and stroke of $4\frac{3}{8}$-in by $5\frac{1}{2}$-in produces a displacement of 649.2-cu. in. Compression ratio is 17.8 to 1.

Internal components of the engine are generally similar

Deutz F8L614 installed in truck. Added width of air-cooled engine required hood to be made wider.





Cooling fins, ducts and swirl type combustion chamber of series 614 are clearly seen.

to conventional vee-type engine design. The principal difference lies in the cylinders and the method of cooling them. Each cylinder is an integral unit. Metal thickness, depth and spacing of fins, length of heat flow paths, etc., have all been figured to provide uniform cooling.

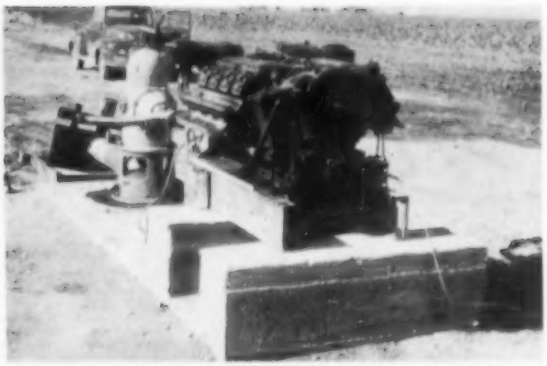
An axial-flow blower is driven from the gear-case end of the engine through a shaft and flexible coupling. Thus, the flow of air delivered is a function of engine speed. It is directed by ducts for most effective cooling and will maintain the design temperatures of power assembly components even under the most severe operating conditions. Accessability to the cylinders is easily obtained by removal of two plate covers.

Each cylinder's clearance volume is principally in a swirl chamber located in the head portion. A throat, tangential to the swirl chamber, connects it to the cylinder proper. A multi-plunger injection pump supplies fuel to the injector of each cylinder where it is delivered directly into the swirl chamber. There is also a glow plug in this chamber to facilitate cold starting.

Deutz representatives point out that the best evidence of even cooling and maintenance of proper running tolerances is the fact that the engine is easy on both fuel and lube oil. The combustion system is also a factor. Other advantages cited for this air-cooled design are freedom from freeze-up worries, liquid cooling system problems, rapid attainment of operating temperatures, and weight economies.

Air-cooling is nothing new to Deutz. Up to a year ago, about 150,000 such units had been placed in operation. International selling has put these engines in a broad range of climatic and altitude conditions. Also, service and parts facilities are equally widespread. Here in this country, similar facilities exist and are being expanded.

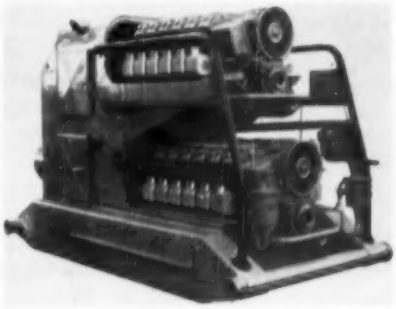
Usage is not confined to over-the-road use. In the uranium mines of Colorado, Utah and New Mexico over 100 ore carriers use the Model 2L612's. At Curtis, Nebraska, an inline unit pumps water from one of the



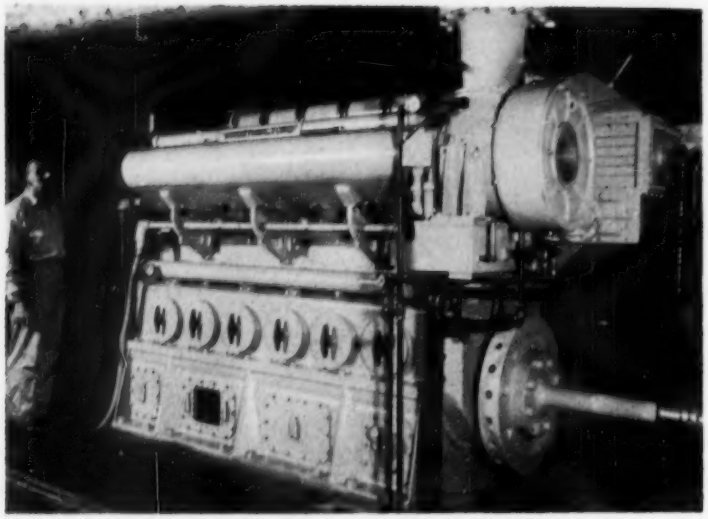
Deutz air-cooled engine pumps water at Curtis, Nebraska. This is one of deepest wells in the state.

deepest wells in the state. In the oil fields, "piggy back" units (one engine above the other with coupled output) are used. In other applications they drive irrigation pumps, generators, and compressors.

So in selecting this engine for their new transport-tractor, FWD is not getting an untried unit. And while air-cooled engines in this size are not common here, it is interesting to note a comment by Dr. Richard Kloss, Deutz research director, in a paper before a New England Section SAE Meeting. He observed that at the last technical fair in Hanover, Germany, 58% of all units exhibited were equipped with air-cooled diesel engines.



Other uses of Deutz air-cooled engine include "piggy-back" set used in oil fields and ore carrier used in uranium mines of western U. S.



Worthington's SW-9, 6-cyl, turbocharged high specific output engine is shown on test connected to a dynomometer. This engine has 200-psi bmep and uses lowest cost fuels.

Wells, Nevada, Boosts Plant Capacity

By C. J. Watts, Worthington Corporation

Power for an important crossroad-of transportation and communications is being firmed by installation of a high specific output diesel.

DEPENDABLE power is a necessity in Wells, Nev. Operating under severe climatic conditions ranging from 100°F to minus 40°F, the Wells Power Co. must give uninterrupted service to this cattle center of 1000 persons, 187 miles west of Salt Lake City. Located where transcontinental Highway 40 crosses U. S. Highway 93, this town was originally a wagon train oasis during pioneer days.

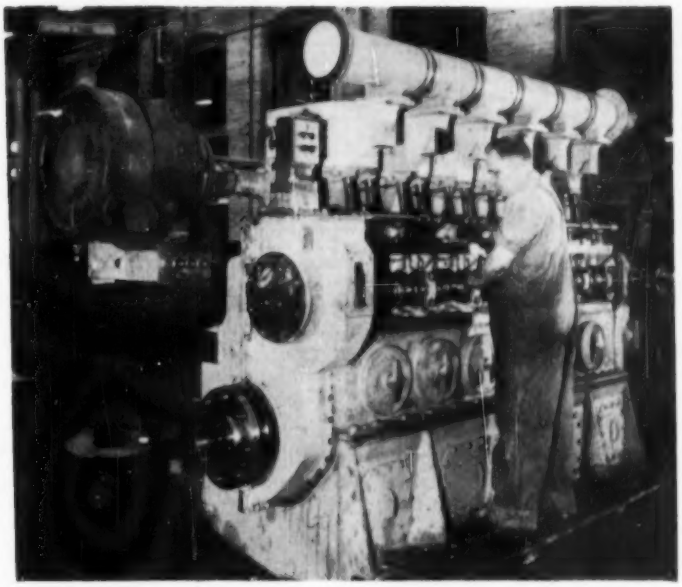
Today the town has grown to the point where the Oregon Short Line Railroad operates a branch line between Twin Falls and Wells. The Southern Pacific and Western Pacific Railroads also go through the town. Airlines communications systems, transcontinental telephone microwave communications, television stations and far-flung isolated ranches depend on the Wells Power Co. for power.

Hence the importance of continuous around-the-clock service from this key power plant in this small town located at one of the cross roads of the nation. But this plant didn't always play such an important role. Up until 1927 the people of Wells and the surrounding ranches provided their own lighting facilities. Coal-oil and gasoline lamps predominated but there were 12 individual gasoline engine-driven light plants in use.

Plant History

The Wells Power Co., incorporated in March 1927, was the brainchild of Harry H. Cazier, son of a pioneer. In the early days of the company its operation was carried out almost single-handed by Harry Cazier. He is still president of the company but is now assisted by George L. Blackett the plant manager. Following incorporation of the Wells Power Co. a 120-kw Pelton water wheel was purchased. This was direct connected to a General Electric 480-v, 60-cycle, 3-phase, 450-rpm generator.

There were about 65 customers in those days and the peak load was around 50 kw with an average load of 35 kw. From 1927 to 1929 the hydro generator operated without standby. During this period there was only one major shut down caused by governor belt failure which resulted in the water wheel running away, burning up the exciter. To insure against future blackouts two used Sterling



Engine is being assembled prior to testing and shipment. Turbocharger can be seen at upper left. Compact and rugged construction is apparent. Parts are easy to get to.

"Dolphin" gasoline engines, each driving a 90-kw generator were bought in 1929 for standby service.

With installation of the two 90-kw standby units the power plant expanded its operation by running a transmission line through Starr Valley to Deeth, Nev., 28 miles to the west of Wells. These engines were used primarily as standby units until 1937 when the load demanded their use for peaking.

In 1939 the first new high-speed diesel engine was purchased. It had a rating of 50 kw. A new 90-kw diesel generator was bought in 1945 followed by another 90-kw unit 1947. When the latter unit was in operation, the 50-kw unit and one of the Sterling engines were removed from service. A third 90-kw unit was installed in 1948. In 1950 a 279-kw high-speed diesel generator was installed followed by another 279-kw unit in 1951 at which time the second Sterling engine was retired.

The demand for power grew through the years, rather slowly but steadily, up to 1945. Since 1946 power consumption has risen sharply. Because of the continued increase in demand and since additional hydro development is limited, the Wells Power Co. realized that the firm capacity of the system must be generated with diesel engines.

With this in mind they proceeded to buy a Worthington diesel generator late in 1955.

Wells' Newest Generator Set

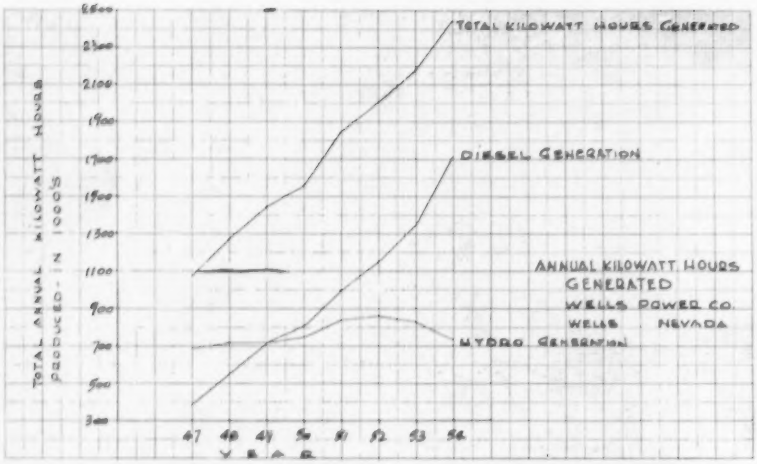
The new engine is a SW9, 6-cyl, turbocharged, 9-in bore, 11-in stroke, 900-rpm diesel driving a 500-kw G. E. 480-v, 60-cycle, 3-phase generator. The SW-9 is structurally designed for continuous operation at more than 200-psi bmep and is capable of using the lowest cost fuels available. It is compact, has high structural strength yet with a low weight per horsepower ratio. An important design feature of the engine is the jet-swirl air intake passages which bring air in parallel to the inlet valve stem and gives it a swirl as it enters the cylinder. This results in maximum air turbulence for complete fuel-air mixture and best fuel economy. (DIESEL POWER, Dec. 1955). To house the Worthington unit a new building is being constructed.

The piping to the engine and auxiliaries will be simple. For example, the raw water pump will take its suction from the cooling tower sump and will discharge to two parallel lines. One will supply tower water to the engine air after-cooler. This flow will be controlled by a temperature regulating valve actuated by the air temperature leaving the after-cooler. Water leaving the after-cooler returns directly to the cooling tower.

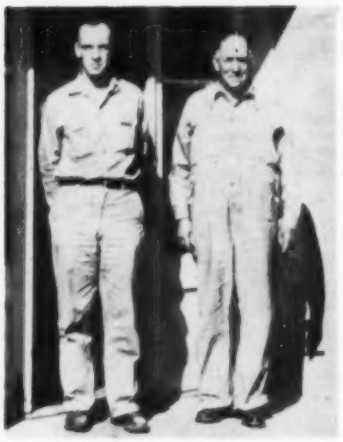
The second parallel line at the pump discharge will supply, in series, the lube oil cooler and jacket water heat exchangers. Raw water leaving the jacket water heat exchanger returns directly to the cooling tower. A standby raw water circulating pump, a duplicate of the base pump, will be installed to operate when required.

The jacket water system pump will take suction from the engine water outlet manifold and discharge to a 3-way valve. Part of the flow, when required, will return to the engine and the balance will flow to the jacket water heat exchanger for cooling. Fresh water leaving the jacket water heat exchanger will return to the engine where it enters the engine water inlet manifold.

Part of the flow to the engine will parallel the jacket water inlet supply and cool the turbocharger. The outlet from the turbocharger enters the engine jacket water outlet manifold. Jacket water pump flow is controlled by a


TOTAL KILOWATT HOURS GENERATED
DIESEL GENERATION
ANNUAL KILOWATT HOURS GENERATED WELLS POWER CO. WELLS NEVADA
HYDRO GENERATION
TOTAL ANNUAL KILOWATT HOURS PRODUCED - IN 1000'S
47 48 49 50 51 52 53 54
YEARS

Curves show total kwh developed by Wells Power Co. Almost all of load increase since 1947 was absorbed by diesel generator sets. Reduced load carried by hydro units is seen.



Harry H. Cozier, founder and now president of the Wells Power Co. is at right. With him is plant manager G. L. Blackett.

3-way temperature regulating valve which will maintain 155°F temperature to the engine, with 10°F temperature rise through the engine.

The air supply to the engine is controlled by a thermostatically operated 2-way regulating valve with the actuating bulb located in the air stream leaving the aftercooler. A simple but effective means of controlling the air and water temperature to the engine is thus realized.

The lube oil pump takes suction from the engine oil sump and discharges to a full-flow filter. Filtered oil then enters the lube oil cooler and returns to the engine to again perform its dual function of lubrication and piston cooling.

With addition of the Worthington engine the Wells Power Co. will develop another spring about a mile to the south and higher than the spring from which the present hydro obtains its water. A water wheel will be installed below the second spring. This one connected to a 75-kw induction generator. Studies show this unit will produce an average of 33 kw. The water from the tailrace will then flow by pipe line to the existing reservoir at the head of the lower hydro plant. This additional water will increase the average output of the lower hydro approximately 20 kw. The total average increase in hydro output thus realized by developing the upper spring will be about 53 kw, or more than 50% increase in total annual hydro kwh production.

System Load and Power Distribution

The power generated by the Wells Power Co. is used primarily for lighting and the operation of small motors. There is no industrial load on the system. Power is generated at 480 volts and distributed at 7200 volts. There are approximately 90 miles of transmission and distribution lines.

Today this company serves about 548 customers with a peak load in 1954 of 550 kw. At Deeth 25 customers are served with 49 Starr Valley customers taking power from the Deeth line. One customer, the 71 Ranch, 8 miles from the transmission line, consumes approximately 500 kwh per month.

A line runs 28 miles to the east of Wells to serve a Bell Telephone Co. microwave relay station at Rocky Point on the summit of the Pequop Mountains. The average load requirement of the station is 7½ kw. About 6 miles west of Wells, the Ruby microwave relay station is served. The load at this station averages 6 kw. The Wells Power Co. also furnishes power to two Bell Telephone Co. under ground telephone cable repeater stations, one about ½ mile south of Wells, the other at Deeth. The average load at each repeater station is 3 kw.

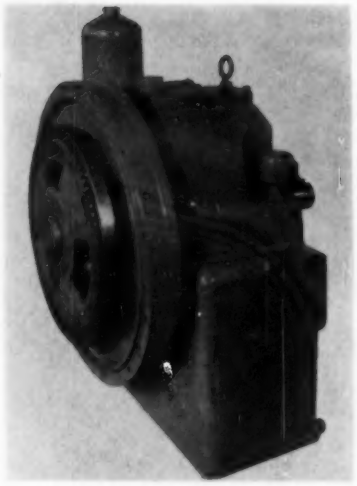
Power is furnished for a high frequency (Omni range) radio station operated by the Civil Aeronautics Administration. This station is 1½ miles north of Wells and requires an average of 4½ kw. To direct airplanes to Elko, a fan marker is located at Deeth. Its average load requirement is 1½ kw. This too, is served by the Wells Power Co. system.

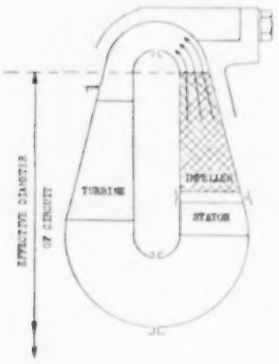
Conclusion

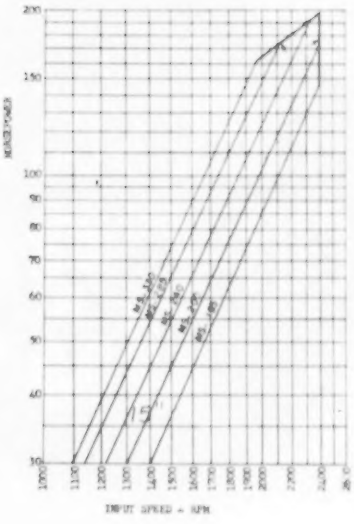
To be sure, the power requirements of the communications systems served by the Wells Power Co. are small, but it's extremely important that these stations be served without interruption. Failure of any one of these systems whose operation depends on this power company may easily result in loss of property, or even life. The Wells Power Company's choice of diesel power to insure and safeguard their operations is typical of the action taken by many key power plants.

Principal Equipment

SW9-6 Diesel Engine	Worthington Corporation
Generator and Exciter	General Electric Co.
Exhaust Silencer	The Maxim Silencer Co.
Air Intake Filter-Silencer	American Airfilter Co.
Lube Oil & Water Heat Exchangers	The Sims Co.
Full-flow Lube Oil Filter	The Cuno Engineering Corp.
Pyrometers	Illinois Testing Laboratories
Jacket Water & Cooling Tower Pumps	Worthington Corp.







At left is spider-driven torque converter. Single-stage circuit is seen above. Horsepower capacities with different impellers are at right. Arrows show normal limits. Option mounting and drives are shown below.

Torque Converter Line with Combination of New Features.

NOW, the hydraulic torque converter has proved its value both operationally and in dollars-and-cents in a great variety of applications. Today, the principal question is not whether or not to use a converter but the proper selection to provide the best operating characteristics.

Multiplication ratios, capacities, efficiencies, input and output arrangements, and even size are factors that the designers consider to get the best possible match between the engine and its load. And all converter builders are intent on broadening their line to meet expanding applicational needs.

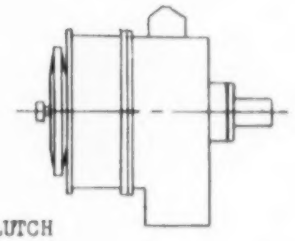
Typical is the addition of Twin Disc's 1500-size single-stage converters. Addition of this 15-in line gives Twin Disc a very complete range of torque converters and fluid couplings to meet the broad range of industrial needs. These units were designed for such applications as shovels, yarders, front-end loaders, bucket loaders, industrial lift trucks and others in which single-stage converters have certain advantages.

This is Twin Disc's own design, not the result of any license, and they have been working on it and field testing it for years. A distinctive feature is the unit's "unloading" arrangement. This is done through blading arrangement and design rather than by the more conventional use of free-wheeling stator devices.

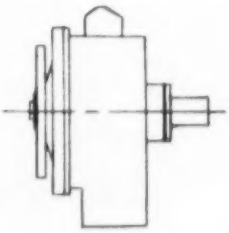
The blading design is such that at high operating speed ratios the turbine develops a "counter-head" that stops fluid circulation. Use of this system eliminates parts and simplifies construction.

Following out this theme of simplification, impellers having different blading, both number of blades and pitch, fit the housing interchangeably. By selection, torque capacities can be matched as accurately as possible to various engine horsepower outputs and speeds within the unit's rated limits. No change in the converter housing or other components is necessary.

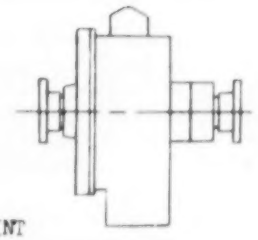
Minimum and maximum ranges of the converter are respectively, 30 hp at 1100 rpm and 198 hp at 2400 rpm. Specific torque ratings are 165, 200, 240, 285 and 330 lb-ft, depending upon the impeller selected.



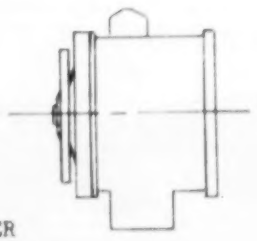
CLUTCH



SPIDER



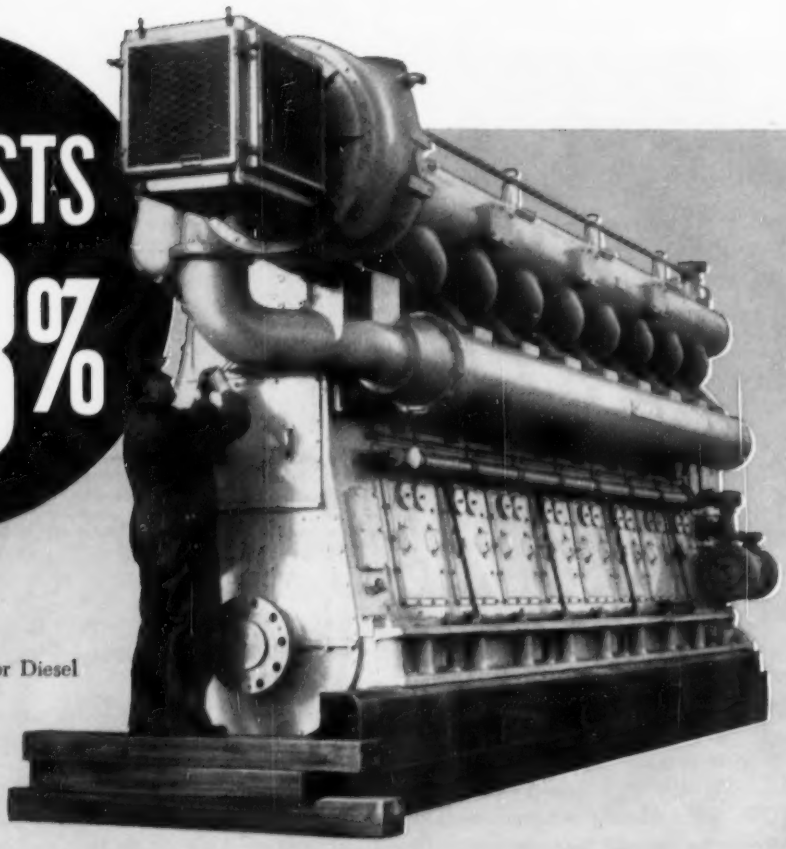
U-JOINT



SPACER

Engine specifications start after Page 68.
Editorial articles continued on Page 81.

FUEL COSTS CUT 53%



1400 B.H.P. Superior Diesel
Model 80-M4X-8

"Johnstone Straits" repowered with new SUPERIOR diesel

...operates successfully on low cost bunker fuel!

This new 1400 H.P. Superior Diesel was installed in 1955 in the 118 foot tug "Johnstone Straits" owned by Straits Towing Ltd., of Vancouver, B. C. Due to the rugged open chamber Superior combustion system and the special know-how of White Diesel engineers, *the tug now operates almost exclusively on low cost bunker fuel!* This has resulted in a 53% fuel cost savings!

The tug is in service on the rugged British Columbia Coast, towing record-size log booms and large sea-going barges. The new 1400 H.P. direct-reversing Superior Diesel swings an 88" diameter, 36"/43" pitch wheel at 350 turns.

Due to the engine's superior performance, when operating on heavy fuel, Straits Towing has made it a matter of practice to use heavy fuel during normal maneuvering. When the engine is to be secured for short periods, up to half an hour, they also stop and start it on heavy fuel.

If fuel savings of this sort, plus the famous dependability, low maintenance cost and minimum down time of Superior and Atlas Diesels interest you, please get complete details from the nearest Sales and Service office listed below. There is a Superior or Atlas Diesel for every marine use from 100 to 2105 B.H.P.

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Baldwin-Lima-Hamilton Corp.
The Buda Company
Caterpillar Tractor Co.
Cleveland Diesel Engine Div., GMC
Continental Motors Corp.
The Cooper-Bessemer Corp.
Cummins Engine Co., Inc.
Detroit Diesel Engine Div., GMC
Electro-Motive Division, GMC
Hercules Motors Corp.
International Harvester Co.
The National Supply Co.
Waukesha Motor Co.
Eaton Manufacturing Company
Link-Belt Company
Worthington Pump and Machinery Corp.
Thompson Products Company

And These Are Some of the TOCCO-Hardened Parts They Use

Crankshafts
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Adjusting Screws
Cylinder Liners
Rocker Arms
Cam Followers
Valves
Rocker Arm Shafts
Timing Gears
Shifter Forks
Transmission Gears
Final Drive Gears
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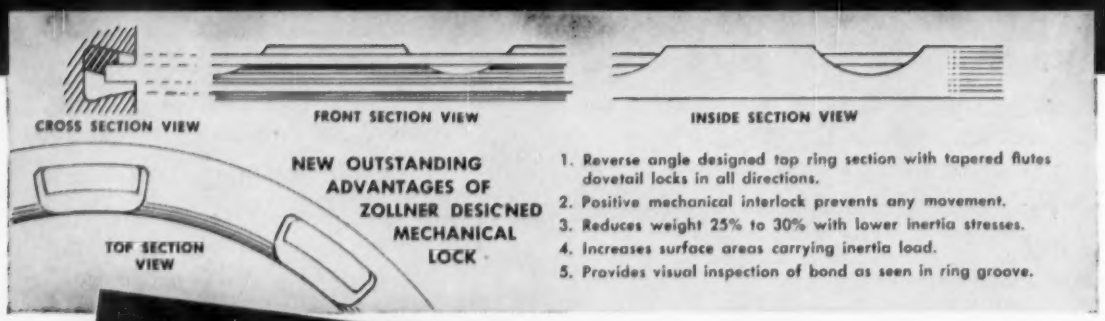
WITH "NI-RESIST" IRON TOP RING SECTION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2. Positive mechanical interlock prevents any movement.
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THE ORIGINAL EQUIPMENT PISTONS

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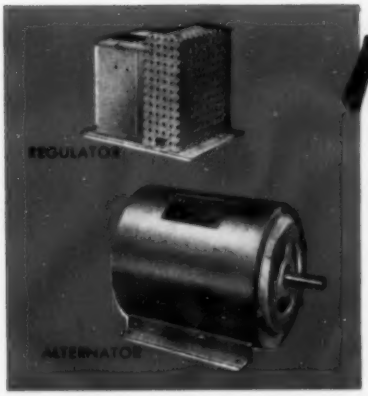

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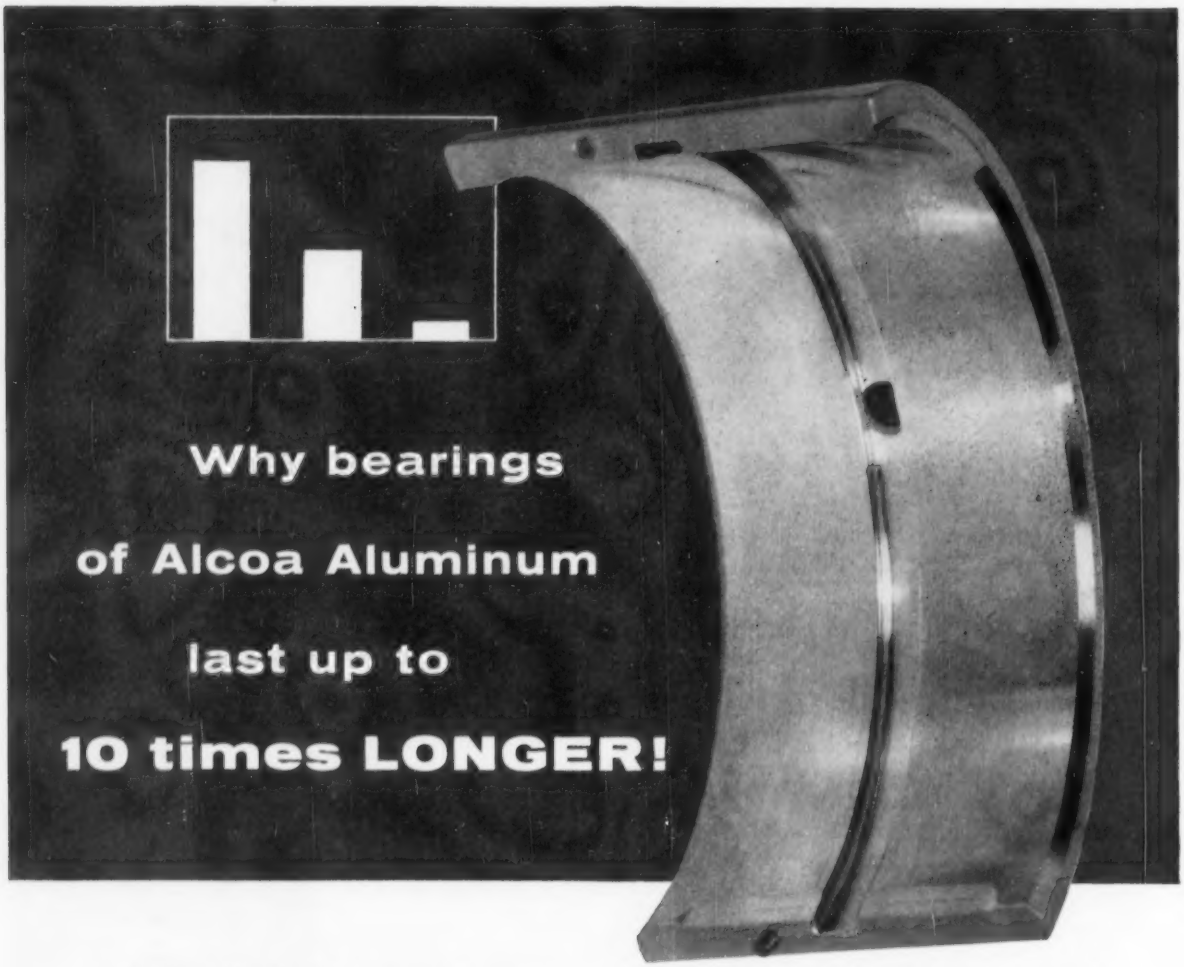

A leading diesel engine manufacturer increased the life of their crankshaft bearings *at least 10 times* by switching from babbitt to solid bearings of Alcoa® Aluminum. Bearings of Alcoa Aluminum are outperforming babbitt and bronze in hundreds of other applications—because aluminum has an *unmatched combination of advantages.*

Highest load capacity—Solid aluminum bearings withstand the highest loads—up to 10,000 psi on projected area in certain applications. Aluminum bearings are the only solid bearings suitable for heavy-duty service.

20° cooler running—Aluminum is the best heat conductor of *all* bearing metals. Result: aluminum bearings run up to 20° cooler than other bearings. Where hot spots are likely, there's far less danger of seizure.

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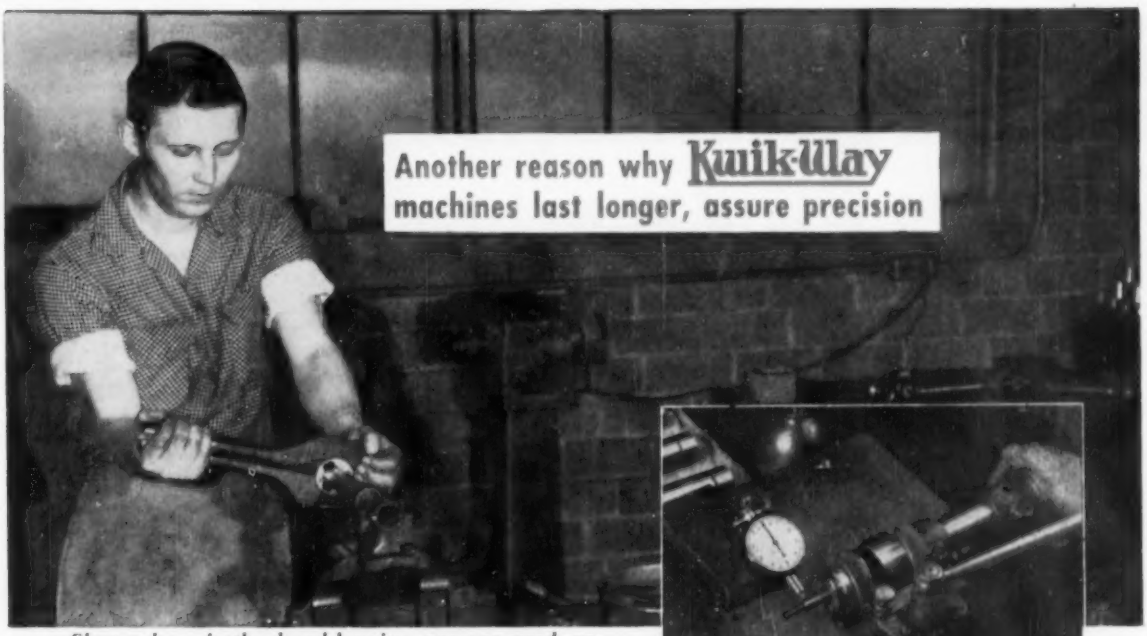
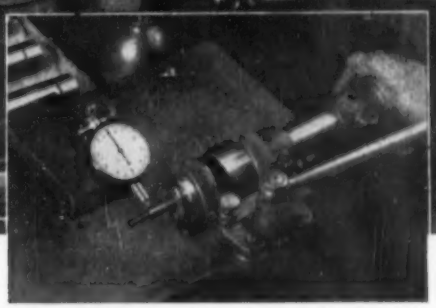
Your Guide to the Best in Aluminum Value



Shown here is the hand-lapping process used on every chuck shaft and chuck collar.



After the hand-lapping phase, the completed chuck assembly is checked with a series of hardened and ground arbors to insure accurate, precise operation throughout the entire range.

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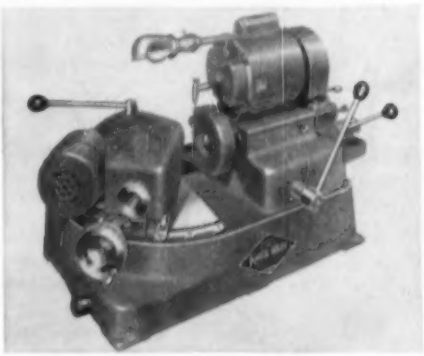
The chuck collar and chuck shaft of Kwik-Way Super-Matic Valve Facing Machines are hand-lapped for perfect fit, so that the valve rotates completely free of waver or vibration.

The sockets in the shaft which hold the special centering balls that grip the valve stem are hand-lapped, too. This careful handwork by skilled craftsmen makes absolutely certain that the facing is smooth, pitless and unmarked.

Inside the chuck, the least worn portion of the valve stem is gripped by two sets of three balls. This means that each valve face is finished so that it is concentric to the center line of that part of the stem that operates in the valve guide.

Hand-lapping of the chuck collars, shaft and ball sockets, by skilled craftsmen, is another reason why Kwik-Way Super-Matic Valve Facing Machines are unequalled for precision.



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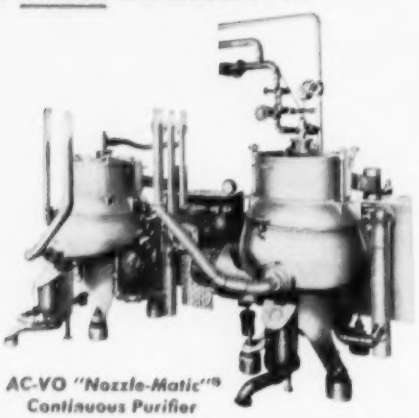

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And, today, there is also no question of getting the *precise* centrifugal purifier to prepare heavy fuel for any particular set of circumstances . . . *De Laval* provides three different types. Each type has proved its efficiency and freedom from trouble in many installations, both land and marine.

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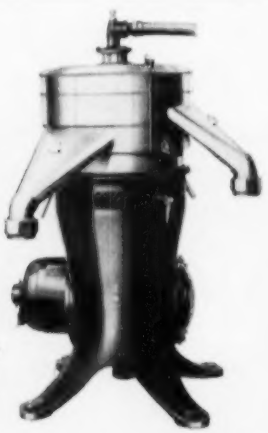

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RECOMMENDED CAPACITIES — G.P.H.

VIS.	TEMP.	AC-VO	PX 209. F	STANDARD PURIFIER
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700	180° F	1100	550	275
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2500	180° F	560	280	140
4000	190° F	440	220	110
5000	200° F	300	150	75

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ENGINE SPECIFICATIONS 1956

Diesel Dual-Fuel Natural Gas

Data on Engines Manufactured by American Diesel Engine Builders

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Baldwin-Lima-Hamilton Corp. S-2
Buda Co. S-2
Caterpillar Tractor Co. S-3
Chicago Pneumatic Tool Co. S-3
Clark Brothers Co. S-4
Climax Engine & Pump Mfg. Co. S-4
Continental Motors Corp. S-4
Cooper-Bessemer Corp. S-5
Cummins Engine Co., Inc. S-5
Enterprise Engine & Machinery Co. S-5
Fairbanks, Morse & Co. S-6
GM-Cleveland Diesel Div. S-6
GM-Detroit Diesel Engine Div. S-6
GM-Electro-Motive Div. S-7
Gray Marine Motor Co. S-7
Hallett Mfg. Co. S-7
Harnischefeger Corp., P&H Diesel Div. S-7
Hercules Motors Corp. S-7
Ingersoll-Rand Co. S-8
International Harvester Co. S-8
Kahlenberg Brothers Co. S-9
Lathrop Engine Co. S-9
Le Roi Div.-Westinghouse S-9
Lufkin Foundry & Machine Co. S-9
Mack Motor Truck Corp. S-9
Minneapolis-Moline Co. S-9
Murphy Diesel Co. S-10
Nordberg Mfg. Co. S-10
Oliver Corp. S-10
Rathbun-Jones Engineering Co. S-10
R. H. Sheppard Co., Inc. S-11
Sterling Engine Co. S-11
Union Diesel Engine Co. S-11
Venn Severin Engine Works, Inc. S-11
Waukesha Motor Co. S-11
White Motor Co. S-12
White-Roth Machine Co. S-12
Witte Engine Works S-12
Wolverine Motor Works, Inc. S-13
Worthington Corp. S-13

Foreign Diesel Engines Being Actively Sold in This Country

Brush ABOE, Inc. S-14
Bamfords S-14
Burmeister and Wain American Corp. S-14
Crofton Industrial Diesel Engines S-14
Henschel & Sohn S-15
Klockner-Humboldt-Deutz S-15
Lister-Blackstone S-15
M.A.K. S-16
M.A.N. S-16
Sulzer Bros., Ltd. S-16

SYMBOL MEANINGS

Use

M—Marine propulsion service
S —Stationary service implying permanence of installation
P —Mobile, portable, or transportational service

Type

A —Diesel
B —Spark ignition natural gas engine
C—Diesel and dual-fuel
D —Diesel, dual-fuel, and natural gas engine

Starting System

A —Air starting
E —Electric starting
G—Gasoline engine starting
H—Hand cranking

Fuel System

O—Own manufacture
B —American Bosch
S —Bendix-Scintilla
R —Roose-Master
D —Demco
A —Adeco

Ignition

B —Battery system
LM—Low tension magneto
HM—High tension magneto
P —Pulse generator

Supercharging Systems

M—Mechanical
T —Turbocharger

Reverse Gears

D —Direct reversing
S —Snow-Nabstedt
T —Twin Disc
C —Capitol
W—Western Gear
P —Paragon
O—Own manufacture
F —Falk

Notes:
Model numbers are for basic engines and may vary for other ratings and uses.
Dimensions are given to the next largest inch.
Dimensions and weights are for basic model unless otherwise indicated.

Alco Products, Inc.
30 Church Street, New York, N. Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
6-9 x 10½	C	M-S-P	4	6	9 x 10½	550-900	720-1000	B	....	E-A	T	F	136	60	98	22100
12-9 x 10½	C	M-S-P	4	12	9 x 10½	1100-1800	720-1000	B	....	E-A	T	D-F	158	61	110	32650
16-9 x 10½	C	M-S-P	4	16	9 x 10½	1470-2400	720-1000	B	....	E-A	T	D-F	197	61	104	42000
6-12½ x 13	C	S-P	4	6	12½ x 13	580-660	600-740	B	....	E-A	....	F	156	60	82	34000†
6-12½ x 13T	C	S-P	4	6	12½ x 13	810-1000	600-740	B	....	E-A	T	F	156	60	115	36000†
8-12½ x 13	C	S	4	8	12½ x 13	775-860	600-720	B	....	A	....	....	200	60	96	49000
8-12½ x 13T	C	S	4	8	12½ x 13	1080-1300	600-720	B	....	A	T	....	225	60	115	50000

† *Dimensions and weight for portable unit.*

Baldwin-Lima-Hamilton Corp.
Hamilton, Ohio

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
T-495-SA	A	M-S-P	4	4	9½ x 12	530-700	720-950	D	....	A-E	T	C	107	51	88	19500
T-695-SA	A	M-S-P	4	6	9½ x 12	800-1050	720-950	D	....	A-E	T	C	134	51	80	22500
T-895-SA	A	M-S-P	4	8	9½ x 12	1060-1400	720-950	D	....	A-E	T	C	161	51	80	27000
606-NA	C	M-S	4	6	12¾ x 15½	430-750	360-625	B-S	....	A-E	....	D	159	76	91	35000
608-NA	C	M-S	4	8	12¾ x 15½	575-1000	360-625	B-S	....	A-E	....	D	195	76	91	43500
606-SC	C	M-S	4	6	12¾ x 15½	650-1320	360-625	B-S	....	A-E	T	D	170	86	91	36500
608-SC	C	M-S	4	8	12¾ x 15½	865-1750	360-625	B-S	....	A-E	T	D	212	89	91	45000
521-SA	A-C	M-S	2	5	21½ x 27½	2425-2800	257-277	B	....	A	....	D	267	80	161	175000
621-SA	A-C	M-S	2	6	21½ x 27½	2910-3360	257-277	B	....	A	....	D	304	80	161	205000
721-SA	A-C	M-S	2	7	21½ x 27½	3395-3920	257-277	B	....	A	....	D	341	80	161	233000
821-SA	A-C	M-S	2	8	21½ x 27½	3880-4480	257-277	B	....	A	....	D	378	80	161	262500
921-SA	A-C	M-S	2	9	21½ x 27½	4365-5040	257-277	B	....	A	....	D	415	80	161	292000
1021-SA	A-C	S	2	10	21½ x 27½	4850-5600	257-277	B	....	A	....	....	478	80	161	321000
1221-SA	A-C	S	2	12	21½ x 27½	5820-6720	257-277	B	....	A	....	....	552	80	161	380000
324-DA*	A	M-S	2	3	24 x 36	1585-3000	100-180	O	....	A	....	D	...	...	...	.....
424-DA	A	M-S	2	4	24 x 36	2115-4000	100-180	O	....	A	....	D	310	111	236	.....
524-DA	A	M-S	2	5	24 x 36	2640-5000	100-180	O	....	A	....	D	356	111	236	441000
624-DA	A	M-S	2	6	24 x 36	3170-6000	100-180	O	....	A	....	D	402	111	236	514000
724-DA	A	M-S	2	7	24 x 36	3700-7000	100-180	O	....	A	....	D	447	111	236	588000
824-DA	A	M-S	2	8	24 x 36	4225-8000	100-180	O	....	A	....	D	492	111	236	661000
924-DA	A	M-S	2	9	24 x 36	4750-9000	100-180	O	....	A	....	D	538	111	236	735000
1024-DA	A	M-S	2	10	24 x 36	5280-10000	100-180	O	....	A	....	D	583	111	236	808000

* *SA indicates single acting; DA indicates double acting.* *Weights are net for engine only.*

The Buda Company
Harvey, Illinois

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
2BD77	A	M-S-P	4	2	3⅛ x 4½	13.4-15.8	1800-2000	B	....	E	....	S	22	23	31	500•
4BD153	A	M-S-P	4	4	3⅛ x 4½	28-34	2000-2400	B	....	E	....	S	31	23	31	680•
6BD230	A	M-S-P	4	6	3⅛ x 4½	42-60	2000-2400	B	....	E	....	S	39	23	31	850•
4BD182	A	M-S-P	4	4	3⅝ x 4½	32-39	1800-2400	B	....	E	....	S	31	23	31	710•
6BD273	A	M-S-P	4	6	3⅝ x 4½	50-65	1800-2400	B	....	E	....	S	39	23	31	890•
6DAM273	A	M	4	6	3⅝ x 4½	85	2800	B	....	E	....	S	57	24	32	995
6DT317	A	M-S-P	4	6	3⅝ x 5½	56-79	1800-2300	B	....	E	....	S	42	28	41	1150•
6DT468	A	M-S-P	4	6	4¼ x 5½	76-96	1600-2000	B	....	E	....	S	48	27	40	1245•
6DTS468	A	P	4	6	4¼ x 5½	135	2400	B	....	E	M	....	48	34	42	1565
6DAS516	A	P	4	6	4⅛ x 5⅛	165	2400	B	....	E	M	....	48	34	48	1625

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
6DA779	A	S-P	4	6	5¼ x 6	120–165	1400–1900	B	....	E	....	....	59	30	49	2552*
6DA844	A	M-S-P	4	6	5¼ x 6½	140–190	1200–1950	B	....	E	....	S	59	30	49	2630*
6DAS844	A	M-S-P	4	6	5¼ x 6½	155–245	1400–1950	B	....	E	M	S	59	35	49	2674*
8DA1125	A	M-S-P	4	8	5¼ x 6½	171–250	1400–1950	B	....	E	....	S	76	30	51	3400*
8DAS1125	A	M-S-P	4	8	5¼ x 6½	192–300	1400–1950	B	....	E	M	S	78	34	51	3580*
6DC970	A	S-P	4	6	5⅝ x 6½	140–178	1400–1800	B	....	E	....	....	59	30	49	2600*
8DC1290	A	S-P	4	8	5⅝ x 6½	190–243	1400–1800	B	....	E	....	....	76	30	51	3450*
6DC1879	A	M-S-P	4	6	6¾ x 8¼	171–232	900–1200	B	....	A-E	....	S	96	54	65	6925*
6DCS1879	A	M-P	4	6	6¾ x 8¼	284	1200	B	....	A-E	M	S	100	54	65	7900*
8DC2505	A	M-S	4	8	6¾ x 8¼	216–325	900–1200	B	....	A-E	....	W	149	52	92	12840**
8DCS2505	A	M-S	4	8	6¾ x 8¼	320–430	900–1200	B	....	A-E	M	W	158	64	92	13240**
4B153	B	S-P	4	4	3⅛ x 4½	41	2000	..	B-HM	E	....	....	51	23	39	780
4B182	B	S-P	4	4	3⅜ x 4½	46	2000	..	B-HM	E	....	....	51	23	39	780
6B230	B	S-P	4	6	3⅛ x 4½	57.5	2000	..	B-HM	E	....	....	57	23	39	960
6B273	B	S-P	4	6	3¾ x 4½	69	2000	..	B-HM	E	....	....	57	23	39	960
HP326	B	S-P	4	6	3 15/16 x 4¾	69	1800	..	B-HM	E	....	....	61	27	46	1164
HP351	B	S-P	4	6	3 15/16 x 5⅛	74	1800	..	B-HM	E	....	....	61	27	46	1164
K428	B	S-P	4	6	4⅝ x 4¾	97	1800	..	B-HM	E	....	....	71	32	52	1810
L525	B	S-P	4	6	4½ x 5½	96	1600	..	B-HM	E	....	....	71	32	52	1860
LO525	B	S-P	4	6	4½ x 5½	118.5	1600	..	B-HM	E	....	....	73	30	53	2050
6MO893	B	S-P	4	6	5⅝ x 6	174	1400	..	B-HM	E-G	....	....	95	39	64	3815
6MO970	B	S-P	4	6	5⅝ x 6½	188	1400	..	B-HM	E-G	....	....	95	39	64	3830
8MO1290	B	S-P	4	8	5⅝ x 6½	261	1400	..	B-HM	E-G	....	....	111	46	74	5420
8MOS1290	B	S-P	4	8	5⅝ x 6½	283	1400	..	B-HM	E-G	M	....	112	52	75	5900
6PC1879	B	S-P	4	6	6¾ x 8¼	234	1000	..	B-HM	A-E-G	....	....	123	48	83	9100
6PCS1879	B	S-P	4	6	6¾ x 8¼	292	1000	..	B-HM	A-E-G	M	....	132	60	89	11050
8PC2505	B	S-P	4	8	6¾ x 8¼	362	1000	..	B-HM	A-E-G	....	....	141	64	93	12640
8PCS2505	B	S-P	4	8	6¾ x 8¼	440	1000	..	B-HM	A-E-G	M	....	150	64	88	14289

** Weights and dimensions for portable units. ** Weights and dimensions for stationary units. All diesel engines have Lanova combustion system.*
1955 Listings given. 1956 Data not available.

Caterpillar Tractor Company
Peoria, Illinois

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
D-311	A	S-P	4	4	4 x 5	43.5–57	1800–2000	O		E-G			58	27	51	1800
D-315	A	M-S-P	4	4	4½ x 5½	62–82	1800–2000	O		E-G		T	59	30	50	2200
D-318	A	M-S-P	4	6	4½ x 5½	90–119	1800–2000	O		E-G		T	66	31	50	3100
D-326F	A	M-S-P	4	6	5½ x 6½	137–184	1800–2000	O		A-E-G		T	71	36	58	3550
D-337F	A	M-S-P	4	6	5½ x 6½	186–280	1800–2000	O		A-E-G	T	O	72	36	59	3700
D-339	A	S-P	4	4	5¾ x 8	100–126	1200	O		A-E-G			61	39	66	3800
D-342	A	M-S-P	4	6	5¾ x 8	152–190	1200	O		A-E-G		T	81	42	62	5140
D-375D	A	M-S-P	4	V-8	5¾ x 8	238–275	1200–1300	O		A-E-G		S-T	84	55	77	8240
D-375D	A	M-S-P	4	V-8	5¾ x 8	302–350	1200–1300	O		A-E-G	M	S	83	54	79	8655
D-375D	A	M-S-P	4	V-8	5¾ x 8	330–383	1200–1300	O		A-E-G	T	S	84	55	79	8700
D-375D	B	S	4	V-8	5¾ x 8	267	1200	O	LM	A-E-G	....	....	84	55	77	8150
D-397D	A	M-S-P	4	V-12	5¾ x 8	360–415	1200–1300	O		A-E-G	....	S	103	57	79	10700
D-397D	A	M-S-P	4	V-12	5¾ x 8	450–520	1200–1300	O		A-E-G	M	S	107	57	79	11200
D-397D	A	M-S-P	4	V-12	5¾ x 8	500–575	1200–1300	O		A-E-G	T	S	106	57	79	11250
D-397D	B	S	4	V-12	5¾ x 8	400	1200	O	LM	A-E-G	....	....	104	54	79	10700

Chicago Pneumatic Tool Company
6 East 44th Street, New York 17, N. Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight
39-CP	D	S-P	4	3	9 x 10½	145	720	S	LM	A	....	....	68	44	67	8900
49-CP	D	S-P	4	4	9 x 10½	195	720	S	LM	A	....	....	84	44	67	10690
69-CP	D	S-P	4	6	9 x 10½	290	720	S	LM	A	....	....	112	44	67	14240
89-CP	D	S-P	4	8	9 x 10½	390	720	S	LM	A	....	....	140	44	67	16750
412-CP	D	S	4	4	11 x 12	330	720	S	LM	A	....	....	106	47	95	21200
512-CP	D	S	4	5	11 x 12	415	720	S	LM	A	....	....	124	55	95	25300
612-CP	D	S-P	4	6	11 x 12	500	720	S	LM	A	....	....	143	55	95	28400
812-CP	D	S	4	8	11 x 12	665	720	S	LM	A	....	....	178	68	95	32800
614-CP	D	S	4	6	11 x 14¼	495	600	S	LM	A	....	....	143	55	95	29800
814-CP	D	S	4	8	11 x 14¼	655	600	S	LM	A	....	....	178	68	95	34500
460-CP	D	S	4	4	16 x 20	600	360	S	LM	A	....	....	171	85	125	64700
462-CP	D	S	4	4	16 x 22	600	327	S	LM	A	....	....	171	85	125	64700
560-CP	D	S	4	5	16 x 20	750	360	S	LM	A	....	....	197	85	125	72800
562-CP	D	S	4	5	16 x 22	750	327	S	LM	A	....	....	197	85	125	72800
660-CP	D	S	4	6	16 x 20	900	360	S	LM	A	....	....	223	85	125	80900
662-CP	D	S	4	6	16 x 22	900	327	S	LM	A	....	....	223	85	125	80900
860-CP	D	S	4	8	16 x 20	1200	360	S	LM	A	....	....	275	106	125	101440
862-CP	D	S	4	8	16 x 22	1200	327	S	LM	A	....	....	275	106	125	101440
69-CPS	D	S-P	4	6	9 x 10½	450	720	S	LM	A	T	....	156	58	84	15740
89-CPS	D	S-P	4	8	9 x 10½	600	720	S	LM	A	T	....	184	58	84	18250
412-CPS	D	S	4	4	11 x 12	500	720	S	LM	A	T	....	128	47	113	23400
512-CPS	D	S	4	5	11 x 12	620	720	S	LM	A	T	....	146	55	113	27600
612-CPS	D	S-P	4	6	11 x 12	750	720	S	LM	A	T	....	164	55	113	31600
812-CPS	D	S	4	8	11 x 12	1000	720	S	LM	A	T	....	215	68	113	35700
614-CPS	D	S	4	6	11 x 14¼	825	600	S	LM	A	T	....	164	55	113	32000
814-CPS	D	S	4	8	11 x 14¼	1100	600	S	LM	A	T	....	215	68	113	36000
623-CPS	D	S	4	6	12 x 13	1365	720	S	LM	A	T	....	196	86	135	34500
625-CPS	D	S	4	6	12 x 15	1125	514	S	LM	A	T	....	196	86	135	34500
823-CPS	D	S	4	8	12 x 13	1820	720	S	LM	A	T	....	225	86	135	42500
825-CPS	D	S	4	8	12 x 15	1500	514	S	LM	A	T	....	225	86	135	42500
1023-CPS	D	S	4	10	12 x 13	2280	720	S	LM	A	T	....	266	86	135	56700
1025-CPS	D	S	4	10	12 x 15	1890	514	S	LM	A	T	....	266	86	135	56700
460-CPS	D	S	4	4	16 x 20	875	360	S	LM	A	T	....	210	85	125	68130
462-CPS	D	S	4	4	16 x 22	875	327	S	LM	A	T	....	210	85	125	68130
560-CPS	D	S	4	5	16 x 20	1100	360	S	LM	A	T	....	236	106	125	76540
562-CPS	D	S	4	5	16 x 22	1100	327	S	LM	A	T	....	236	106	125	76540
660-CPS	D	S	4	6	16 x 20	1350	360	S	LM	A	T	....	262	106	125	84950
662-CPS	D	S	4	6	16 x 22	1350	327	S	LM	A	T	....	262	106	125	84950
860-CPS	D	S	4	8	16 x 20	1800	360	S	LM	A	T	....	320	116	125	106800
862-CPS	D	S	4	8	16 x 22	1800	327	S	LM	A	T	....	320	116	125	106800

Clark Bros. Co.
Olean, New York

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
RAD2	A	S	2	2	14 x 14	200	330	B-S	....	A	....	....	....	....	....	28700
RAD32	A	S	2	3	14 x 14	300	330	B-S	....	A	....	....	....	....	....	33850
RAD4	A	S	2	4	14 x 14	400	330	B-S	....	A	....	....	....	....	....	42700
RAD5	A	S	2	5	14 x 14	500	330	B-S	....	A	....	....	....	....	....	52700
RAD6	A	S	2	6	14 x 14	600	330	B-S	....	A	....	....	....	....	....	65550
RAD8	A	S	2	8	14 x 14	800	330	B-S	....	A	....	....	....	....	....	70400
DG4	A	M-S	2	4	12½ x 16	380-500	300-400	B-S	....	A	....	....	....	....	....	42000*
DG5	A	S	2	5	12½ x 16	475-675	300-400	B-S	....	A	....	....	....	....	....	....
DG6	A	M-S	2	6	12½ x 16	570-750	300-400	B-S	....	A	....	....	....	....	....	56000*
DG8	A	S	2	8	12½ x 16	760-1000	300-400	B-S	....	A	....	....	....	....	....	....
HMA-4	B	S-P†	2	4	8¼ x 8¼	175	600	..	LM	A	....	....	....	....	....	....
HMA-6	B	S-P†	2	6	8¼ x 8¼	265	600	..	LM	A	....	....	....	....	....	....
HMA-8	B	S-P†	2	8	8¼ x 8¼	350	600	..	LM	A	....	....	....	....	....	....
HMA-10	B	S-P†	2	10	8¼ x 8¼	440	600	..	LM	A	....	....	....	....	....	....
HMAB-6	B	S	2	6	8⅝ x 8⅞	330	600	..	LM	A	....	....	....	....	....	....
HMAB-8	B	S	2	8	8⅝ x 8⅞	440	600	..	LM	A	....	....	....	....	....	....
HMAB-10	B	S	2	10	8⅝ x 8⅞	550	600	..	LM	A	....	....	....	....	....	....
HSRA-3	B	S	2	3	14 x 14	440	330	..	LM	A	M	....	....	....	....	....
HSRA-4	B	S	2	4	14 x 14	600	330	..	LM	A	M	....	....	....	....	....
HSRA-5	B	S	2	5	14 x 14	725	330	..	LM	A	M	....	....	....	....	....
HSRA-6	B	S	2	6	14 x 14	880	330	..	LM	A	M	....	....	....	....	....
HSRA-8	B	S	2	8	14 x 14	1200	330	..	LM	A	M	....	....	....	....	....
HRA-8	B	S	2	8	14 x 14	1055	330	..	LM	A	....	....	....	....	....	....
TRA-6	B	S	2	6	14 x 14	1200	360	..	LM	A	T	....	....	....	....	....
TRA-7	B	S	2	7	14 x 14	1450	360	..	LM	A	T	....	....	....	....	....
TRA-8	B	S	2	8	14 x 14	1650	360	..	LM	A	T	....	....	....	....	....
TRA-10	B	S	2	10	14 x 14	1950	360	..	LM	A	T	....	....	....	....	....
HBA-6	B	S	2	6	17 x 17	1200	330	..	LM	A	....	....	....	....	....	....
HBA-6	B	S	2	6	17 x 17	1440	330	..	LM	A	....	....	....	....	....	....
HBA-8	B	S	2	8	17 x 17	1920	330	..	LM	A	....	....	....	....	....	....
HBA-10	B	S	2	10	17 x 17	2400	330	..	LM	A	....	....	....	....	....	....
TLA-6	B	S	2	6	17 x 19	1850	330	..	LM	A	T	....	....	....	....	....
TLA-6	B	S	2	6	17 x 19	2200	330	..	LM	A	T	....	....	....	....	....
TLA-8	B	S	2	8	17 x 19	2950	330	..	LM	A	T	....	....	....	....	....
TLA-10	B	S	2	10	17 x 19	3700	330	..	LM	A	T	....	....	....	....	....

** Marine weight. † Semi portable. All engines have open type combustion chambers.*

Climax Engine & Pump Mfg. Co.
Clinton, Iowa

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
R110	B	S-P	4	4	6⅛ x 7	.....	900	..	B-HM	A-E-G	....	....	58	31	49	2450
R165	B	S-P	4	6	6⅛ x 7	.....	900	..	B-HM	A-E-G	....	....	74	30	51	3250
K67	B	S-P	4	6	7 x 7	.....	900	..	B-HM	A-E-G	....	....	71	30	58	5400
K75	B	S-P	4	6	7⅛ x 7	.....	900	..	B-HM	A-E-G	....	....	71	30	58	5400
V80	B	S	4	8	7 x 7	.....	900	..	B-HM	A-E-G	....	....	79	51	59	8400
V85	B	S	4	8	7⅛ x 7	.....	900	..	B-HM	A-E-G	....	....	79	51	59	8600
V122	B	S	4	12	7 x 7	.....	900	..	B-HM	A-E-G	....	....	103	51	59	11000
V125	B	S	4	12	7⅛ x 7	.....	900	..	B-HM	A-E-G	....	....	103	51	59	11600
C46	B	S	4	1	5 x 6¼	.....	600	..	HM	H-E-G	....	....	47	38	39	1360
C66	B	S	4	1	5¾ x 7⅛	.....	550	..	HM	H-E-G	....	....	53	40	44	1575
C96	B	S	4	1	7 x 8⅛	.....	500	..	HM	H-E-G	....	....	63	47	49	2580

Continental Motors Corporation
Muskegon, Michigan

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
ZD129	A	S**	4	4	3¼ x 3⅞	34	2000	R	....	E	....	....	....	....	....	485
GD157	A	M-S-P	4	4	3⅜ x 4⅛	39	2000	R-B	....	E	....	....	32	16	31	605
ED201**	A	S**	4	4	3⅜ x 4⅞	45.8	2000	R-B	....	E	....	....	....	....	....	655
HD243	A	S-P	4	4	3¾ x 5½	54.7	2000	R-B	....	E	....	....	34	22	35	840
HD260**	A	S**	4	4	3⅞ x 5½	59.3	2000	R-B	....	E	....	....	34	22	35	840
HD277**	A	S**	4	4	4 x 5½	63.2	2200	R-B	....	E	....	....	34	22	35	850
JD382 **	A	S**	4	4	4½ x 6	72.5	1600	B	....	E	....	....	....	....	....	925
TD427	A	S	4	6	4⅛ x 4⅞	106.5	2000	B	....	E	....	....	47	25	36	1300
RD572	A	S	4	6	4⅜ x 5⅜	154	2000	B	....	E	....	....	52	30	43	1845
VD603	A	S	4	8	4⅜ x 4¼	175	2600	R	....	E	....	....	44	34	47	1696
SD802	A	S	4	6	5⅛ x 5½	202	1800	B	....	E	....	....	....	....	....	2160
TD6427	A	M-P	4	6	4⅛ x 4⅞	116	2400	B	....	E	....	....	47	25	36	1270
RD6572	A	M-P	4	6	4⅜ x 5⅜	172	2400	B	....	E	....	....	52	30	46	1785
VD8603	A	P	4	8	4⅜ x 4¼	182	2800	R	....	E	....	....	44	34	47	1680
SD6802	A	M-P	4	6	5⅛ x 5½	225	2200	B	....	E	....	....	....	....	....	2140
Y-69	B	S-P	4	4	2⅛ x 3⅛	21.4	2400	..	B-LM-HM	E	....	....	26	15	26	265
Y-112	B	S-P	4	4	3⅛ x 3⅛	32	2400	..	B-LM-HM	E	....	....	26	15	26	265
F-162	B	S-P	4	4	3⅛ x 4⅝	49	2400	..	B-LM-HM	E	....	....	29	16	29	370
F-226	B	S-P	4	6	3⅛ x 4⅝	73	2400	..	B-LM-HM	E	....	....	36	16	29	510
M-330	B	S-P	4	6	4 x 4⅝	104	2400	..	B-LM-HM	E	....	....	43	22	34	725
R-427	B	S-P	4	6	4⅛ x 4⅞	127	2400	..	B-LM-HM	E	....	....	46	22	34	870
U-801	B	S-P	4	6	4⅝ x 5⅛	160	2400	..	B-LM-HM	E	....	....	52	28	45	1670
R-602	B	S-P	4	6	4⅞ x 5⅜	191.7	2400	..	B-LM-HM	E	....	....	52	28	45	1670
S-749	B	S-P	4	6	5⅜ x 5½	217	2200	..	B-LM-HM	E	....	....	58	28	48	1910

*Horsepower Given is Bare Engine Rating **Available for Industrial Applications only. H.P. is Bare Engine. R.P.M. is Governed Speed.

The Cooper-Bessemer Corporation
Mt. Vernon, Ohio

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
FW6	A	M-S-P	4	6	9 x 10½	430	1000	S	....	A	....	O	130	35	80	17800
FW6T	A	M-S-P	4	6	9 x 10½	900	1000	S	....	A	T	O	176	35	80	18300
FVA8	A	M-S-P	4	8	9 x 10½	575	1000	S	....	A	....	O	102	44	58	22000
FVA8T	A	M-S-P	4	8	9 x 10½	1200	1000	S	....	A	T	O	124	44	58	27240
FVA12	A	M-S-P	4	12	9 x 10½	860	1000	S	....	A	....	O	140	44	58	26000
FVA12T	A	M-S-P	4	12	9 x 10½	1800	1000	S	....	A	T	O	140	44	58	37800
FVA16	A	M-S-P	4	16	9 x 10½	1150	1000	S	....	A	....	O	165	44	58	32000
FVA16T	A	M-S-P	4	16	9 x 10½	2400	1000	S	....	A	T	O	165	44	58	46430
GS6	D	M-S	4	6	10½ x 13½	565	750	O	B	A	....	D	142	38	68	21500
GS6T	D	M-S	4	6	10½ x 13½	1200	750	O	B	A	T	D	174	38	68	22250
GS8	D	M-S	4	8	10½ x 13½	775	750	O	B	A	....	D	175	38	68	29500
GS8T	D	M-S	4	8	10½ x 13½	1600	750	O	B	A	T	D	206	38	68	30250
JS5	D	S	4	5	13 x 16	515	450	O	B	A	....	....	149	45	80	41000
JS6	D	M-S	4	6	13 x 16	705	514	O	B	A	....	D	171	45	80	44000
JS6T	D	M-S	4	6	13 x 16	1485	514	O	B	A	T	D	200	45	80	45000
JS7	D	S	4	7	13 x 16	820	514	O	B	A	....	....	193	45	80	48000
JS7T	D	S	4	7	13 x 16	1735	514	O	B	A	T	....	221	45	80	49000
JS8	D	M-S	4	8	13 x 16	935	514	O	B	A	....	D	210	45	80	51000
JS8T	D	M-S	4	8	13 x 16	1980	514	O	B	A	T	D	239	45	80	52000
LS6	D	M-S	4	6	15½ x 22	965	360	O	B	A	....	D	234	56	120	76000
LS6T	D	M-S	4	6	15½ x 22	2040	360	O	B	A	T	D	251	56	120	77000
LS7	D	S	4	7	15½ x 22	1125	360	O	B	A	....	....	248	56	120	91000
LS7T	D	S	4	7	15½ x 22	2380	360	O	B	A	T	....	270	56	120	92000
LS8	D	M-S	4	8	15½ x 22	1285	360	O	B	A	....	D	276	56	120	106000
LS8T	D	M-S	4	8	15½ x 22	2720	360	O	B	A	T	D	299	56	120	107000
LSV12	D	M-S	4	12	15½ x 22	1925	360	O	B	A	....	D	252	68	117	194500
LSV12T	D	M-S	4	12	15½ x 22	4100	360	O	B	A	T	D	300	68	117	197500
LSV16	D	M-S	4	16	15½ x 22	2565	360	O	B	A	....	D	307	68	117	232500
LSV16T	D	M-S	4	16	15½ x 22	5450	360	O	B	A	T	D	355	68	117	237500

Engines have open combustion chamber. Height is given above shaft. Width is between bolt centers. All weights and dimensions for stationary units.

Cummins Engine Company, Inc.
Columbus, Indiana

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
J-6	A	M-S-P	4	6	4½ x 5	95	1800	O	....	E	....	T	48	27	37	1400†
JF-6	A	M-S-P	4	6	4½ x 5	110	2200	O	....	E	....	T	48	27	37	1450†
JN-6	A	M-S-P	4	6	4½ x 5	125	2500	O	....	E	....	T	48	27	37	1475†
NHC-4	A	M-S-P	4	4	5½ x 6	120	1800	O	....	E	....	T	42	30	47	1690†
JT-6	A	M-S-P	4	6	4½ x 5	175	2500	O	....	E	T	S	48	33	40	1615†
JNS-6	A	M-S-P	4	6	4½ x 5	165	2500	O	....	E	M	S	48	25	40	1600†
NT-6	A	M-S-P	4	6	5½ x 6	250	2100	O	....	E	T	C	61	36	47	2546†
NTO-6	A	P	4	6	5½ x 6	262	2100	O	....	E	T	....	61	36	47	2546†
NRT-6	A	M-S-P	4	6	5½ x 6	335	2100	O	....	E	T	C	61	36	47	2546†
HRC-400	A	M-S-P	4	4	5½ x 6	110	1800	O	....	E	....	T	42	30	47	1640†
JS-600	A	M-P	4	6	4½ x 5	150	2500	O	....	E	M	....	47	25	40	1545†
H-600	A	M-S-P	4	6	4½ x 6	150	1800	O	....	E	....	T	57	30	46	2305†
HR-600	A	M-S-P	4	6	5½ x 6	165	1800	O	....	E	....	T	57	30	46	2305†
HRF-600	A	P	4	6	5½ x 6	180	2000	O	....	E	....	....	61	30	49	2380†
HS-600	A	S-P	4	6	4½ x 6	200	1800	O	....	E	M	T	58	32	47	2580†
NH-600	A	M-S-P	4	6	5½ x 6	200	2100	O	....	E	....	T	59	41	63	2400†
NHH-600	A	P	4	6	5½ x 6	200	2100	O	....	E	....	....	64	55	23	2285†
HRS-600	A	M-S-P	4	6	5½ x 6	225	1800	O	....	E	M	T	58	32	47	2580†
NHS-600	A	M-S-P	4	6	5½ x 6	275	2100	O	....	E	M	C	59	41	61	2775
NHRS-600	A	M-S-P	4	6	5½ x 6	300	2100	O	....	E	M	C	59	41	61	2725†
NHHRS-600	A	P	4	6	5½ x 6	300	2100	O	....	E	M	....	64	55	23	2580†
NVH-1200	A	M-S-P	4	12	5½ x 6	400	2100	O	....	E	....	S	73	41	55	4300†
VT-12	A	M-S-P	4	12	5½ x 6	600	2100	O	....	E	T	C	84	45	60	6120*
L-600	A	M-S	4	6	7 x 10	250	1000	O	....	A-E	....	C	92	44	58	7590*
LR-600	A	M-S	4	6	7¼ x 10	300	1100	O	....	A-E	....	C	92	44	58	7590*
LR-600GAS	B	S	4	6	7¼ x 10	315	1100	..	HM	A-E	....	....	92	44	58	7590*

All except "L" models suitable for automotive and other portable applications.
*† Automotive weight with all accessory equipment; also approx. weight of stationary engine w/o radiator or clutch and approx. weight of marine engine w/o reverse gear. * Stationary engine and approx. marine weight w/o reverse gear. Hp. and RPM are maximum ratings.*

Enterprise Engine & Machinery Co.
Subsidiary of General Metals Corp.
18th & Florida Streets, San. Francisco, Calif.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
DM3	D*	M-S-P	4	3	8 x 10	73-162	450-1000	S	ML-P	A-E	....	**	60	41	64	8000
DM33	D	M-S-P	4	3	8 x 10	116-381	450-1000	S	LM-P	A-E	T	**	60	41	64	8700
DM4	D	M-S-P	4	4	8 x 10	97-216	450-1000	S	LM-P	A-E	....	**	68	41	67	10300
DM34	D	M-S-P	4	4	8 x 10	154-508	450-1000	S	LM-P	A-E	T	**	68	41	67	11100
DM6	D	M-S-P	4	6	8 x 10	146-324	450-1000	S	LM-P	A-E	....	**	92	41	64	13200
DM36	D	M-S-P	4	6	8 x 10	231-762	450-1000	S	LM-P	A-E	T	**	92	41	64	13800
DM8	D	M-S-P	4	8	8 x 10	194-432	450-1000	S	LM-P	A-E	....	**	116	41	64	16100
DM38	D	M-S-P	4	8	8 x 10	308-1015	450-1000	S	LM-P	A-E	T	**	116	41	64	18000
DG-6	D	M-S-P	4	6	12 x 15	273-819	250-750	S	LM-P	A	....	D	147	58	99	38800
DG-36	D	M-S-P	4	6	12 x 15	434-1928	250-750	S	LM-P	A	T	D	147	58	99	39900
DG-8	D	M-S-P	4	8	12 x 15	364-1092	250-750	S	LM-P	A	....	D	181	58	99	48000
DG-38	D	M-S-P	4	8	12 x 15	578-2570	250-750	S	LM-P	A	T	D	181	58	99	49962
DQ-6	D	M-S-P	4	6	16 x 20	647-1036	250-400	S	LM-P	A	....	D	197	74	126	87400
DQ-36	D	M-S-P	4	6	16 x 20	1028-2437	250-400	S	LM-P	A	T	D	197	74	126	89600
DQ-8	D	M-S-P	4	8	16 x 20	863-1381	250-400	S	LM-P	A	....	D	245	74	126	105513
DQ-38	D	M-S-P	4	8	16 x 20	1371-3249	250-400	S	LM-P	A	T	D	245	74	126	107913
DR-6	D	M-S-P	4	6	17 x 21	767-1228	250-400	S	LM-P	A	....	D	197	74	126	89900
DR-36	D	M-S-P	4	6	17 x 21	1219-2889	250-400	S	LM-P	A	T	D	197	74	126	92500
DR-8	D	M-S-P	4	8	17 x 21	945-1637	250-400	S	LM-P	A	....	D	245	74	126	107300
DR-38	D	M-S-P	4	8	17 x 21	1625-3852	250-400	S	LM-P	A	T	D	245	74	126	109960
DRV-12	D	M-S-P	4	12	17 x 21	1228-2455	200-400	S	LM-P	A	....	D	197	96	145	142600
DRV-12-3	D	M-S-P	4	12	17 x 21	2891-5782	200-400	S	LM-P	A	T	D	197	96	145	147900
DRV-16	D	M-S-P	4	16	17 x 21	1637-3274	200-400	S	LM-P	A	....	D	245	96	145	181800
DRV-16-3	D	M-S-P	4	16	17 x 21	3852-7703	200-400	S	LM-P	A	T	D	245	96	145	189100

**All models available with trifuel equipment **Reverse and reduction gear used—make varies.*

Fairbanks, Morse & Company
600 S. Michigan Avenue, Chicago, Ill.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
31A6¼	A	M-S-P	2	5	6¼ x 9	175	720	O	....	A	....	D	....	....	....	.....
31A6¼	A	M-S-P	2	6	6¼ x 9	210	720	O	....	A	....	D	....	....	....	.....
31A6¼	A	M-S-P	2	7	6¼ x 9	245	720	O	....	A	....	D	....	....	....	.....
31A6¼	A	M-S-P	2	8	6¼ x 9	280	720	O	....	A	....	D	....	....	....	.....
31A8½	C	M-S-P	2	5	8½ x 11	300–325	514–525	O	....	A	....	D	....	....	....	.....
31A8½	C	M-S-P	2	6	8½ x 11	360–390	514–525	O	....	A	....	D	....	....	....	.....
31A8½	C	M-S-P	2	7	8½ x 11	420–455	514–525	O	....	A	....	D	....	....	....	.....
31A8½	C	M-S-P	2	8	8½ x 11	480–520	514–525	O	....	A	....	D	....	....	....	.....
31A18	C	S	2	6	18 x 27	2100	277	O	....	A	....	....	....	....	....	.....
31A18	C	S	2	8	18 x 27	2800	277	O	....	A	....	....	....	....	....	.....
31A18	C	S	2	10	18 x 27	3500	277	O	....	A	....	....	....	....	....	.....
32E12	A	S	2	2	12 x 15	120	360	O	....	A	....	....	....	....	....	.....
32E12	A	S	2	3	12 x 15	180	360	O	....	A	....	....	....	....	....	.....
32E14	A	S	2	2	14 x 17	150	300	O	....	A	....	....	....	....	....	.....
32E14	A	S	2	3	14 x 17	225	300	O	....	A	....	....	....	....	....	.....
32E14	A	S	2	4	14 x 17	300	300	O	....	A	....	....	....	....	....	.....
32E14	A	S	2	5	14 x 17	375	300	O	....	A	....	....	....	....	....	.....
32E14	A	S	2	6	14 x 17	450	300	O	....	A	....	....	....	....	....	.....
33F12	A	S	2	5	12 x 15	500	400	O	....	A	....	....	....	....	....	.....
33F12	A	S	2	6	12 x 15	600	400	O	....	A	....	....	....	....	....	.....
33F14	A	S	2	5	14 x 17	575	300	O	....	A	....	....	....	....	....	.....
33F14	A	S	2	6	14 x 17	690	300	O	....	A	....	....	....	....	....	.....
33F14	A	S	2	7	14 x 17	805	300	O	....	A	....	....	....	....	....	.....
33F16	C	S	2	4	16 x 20	800	300	O	....	A	....	....	....	....	....	.....
33F16	C	S	2	5	16 x 20	1000	300	O	....	A	....	....	....	....	....	.....
33F16	C	S	2	6	16 x 20	1200	300	O	....	A	....	....	....	....	....	.....
33F16	C	S	2	7	16 x 20	1400	300	O	....	A	....	....	....	....	....	.....
33F16	C	S	2	8	16 x 20	1600	300	O	....	A	....	....	....	....	....	.....
33F16	C	S	2	10	16 x 20	2000	300	O	....	A	....	....	....	....	....	.....
37F12	A	M	2	5	12 x 15	500	400	O	....	A	....	D	....	....	....	.....
37F12	A	M	2	6	12 x 15	600	400	O	....	A	....	D	....	....	....	.....
37E14	A	M	2	5	14 x 17	575	300	O	....	A	....	D	....	....	....	.....
37E14	A	M	2	6	14 x 17	690	300	O	....	A	....	D	....	....	....	.....
37E14	A	M	2	7	14 x 17	805	300	O	....	A	....	D	....	....	....	.....
37F16	A	M	2	5	16 x 20	1000	300	O	....	A	....	D	....	....	....	.....
37F16	A	M	2	6	16 x 20	1200	300	O	....	A	....	D	....	....	....	.....
37F16	A	M	2	7	16 x 20	1400	300	O	....	A	....	D	....	....	....	.....
37F16	A	M	2	8	16 x 20	1600	300	O	....	A	....	D	....	....	....	.....
37F16	A	M	2	10	16 x 20	2125	300	O	....	A	....	D	....	....	....	.....
38F5¼	D	M-S-P	2	4	5¼ x 7¼	150–330	600–1200	B	....	A-E	....	S	....	....	....	.....
38F5¼	D	M-S-P	2	5	5¼ x 7¼	188–413	600–1200	B	....	A-E	....	S	....	....	....	.....
38F5¼	D	M-S-P	2	6	5¼ x 7¼	225–496	600–1200	B	....	A-E	....	S	....	....	....	.....
38F5¼	D	M-S-P	2	7	5¼ x 7¼	263–578	600–1200	B	....	A-E	....	S	....	....	....	.....
38F5¼	D	M-S-P	2	8	5¼ x 7¼	300–660	600–1200	B	....	A-E	....	S	....	....	....	.....
38F5¼	D	M-S-P	2	10	5¼ x 7¼	375–825	600–1200	B	....	A-E	....	F	....	....	....	.....
38D8½	D	M-S-P	2	4	8½ x 10	400–800	450–900	O	....	A	....	D	....	....	....	.....
38D8½	D	M-S-P	2	5	8½ x 10	500–1000	450–900	O	....	A	....	D	....	....	....	.....
38D8½	D	M-S-P	2	6	8½ x 10	600–1200	450–900	O	....	A	....	D	....	....	....	.....
39D8½	D	M-S-P	2	8	8½ x 10	800–1600	450–900	O	....	A	....	D	....	....	....	.....
38D8½	D	M-S-P	2	10	8½ x 10	1000–2000	450–900	O	....	A	....	D	....	....	....	.....
38D8½	D	M-S-P	2	12	8½ x 10	1200–2400	450–900	O	....	A	....	D	....	....	....	.....
45C3½	A	S	4	1	3½ x 4	5¼	1800	D	....	H-E	....	....	....	....	....	.....
45C4½	A	S	4	1	4½ x 4½	10½	1800	D	....	H-E	....	....	....	....	....	.....
45C4½-2	A	M-S	4	2	4½ x 5¼	25	1800	D	....	H-E	....	C-P	....	....	....	.....
48A3½	A	M-S	4	2	3½ x 4	13½	1800	O	....	E	....	S-T	....	....	....	.....
48A4	A	M-S-P	4	2	4 x 5	16–20	1200–1800	O	....	H-E	....	S-T	....	....	....	.....
48A4	A	M-S-P	4	3	4 x 5	25–30	1200–1800	O	....	H-E	....	S-T	....	....	....	.....
48A4¼	A	M-S-P	4	2	4¼ x 5	18–22	1200–1800	O	....	H-E	....	S-T	....	....	....	.....
48A4¼	A	M-S-P	4	3	4¼ x 5	28–34	1200–1800	O	....	H-E	....	S-T	....	....	....	.....
48A4½	A	M-S-P	4	4	4½ x 5	43–78	1200–2000	O	....	E	....	S	....	....	....	.....
49B4½	A	M-S-P	2	2	4½ x 5½	58	1800	B-S	....	A-E	....	S-T	....	....	....	.....
49B4½	A	M-S-P	2	3	4½ x 5½	90	1800	B-S	....	A-E	....	S-T	....	....	....	.....
49B4½	A	M-S-P	2	4	4½ x 5½	127	1800	B-S	....	A-E	....	S-T	....	....	....	.....
49B4½	A	M-S-P	2	6	4½ x 5½	180	1800	B-S	....	A-E	....	S-T	....	....	....	.....

General Motors Corporation
Cleveland Diesel Engine Division
Cleveland, Ohio

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
3-268A	D	M-S	2	3	6½ x 7	187	1300	GM	....	A-E	....	F	61	41	56*	4600
4-268A	D	M-S	2	4	6½ x 7	250	1300	GM	....	A-E	....	F	71	41	56*	5600
6-268A	D	M-S	2	6	6½ x 7	375	1300	GM	....	A-E	....	F	97	41	67*	6800
8-268A	D	M-S	2	8	6½ x 7†	500	1300	GM	....	A-E	....	F	117	41	67*	8400
6-278A	D	M-S	2	6	8¾ x 10½	600	750	GM	....	A-E	....	F	97	54	89*	16300
8-278A	D	M-S	2	8	8¾ x 10½	800	750	GM	....	A-E	....	F	116	54	89*	18600
12-278A	D	M-S	2	12	8¾ x 10½	1200	750	GM	....	A-E	....	F	154	54	89*	24500
16-278A	D	M-S	2	16	8¾ x 10½	1600	750	GM	....	A-E	....	F	196	54	89*	30000
6-498	D	M-S	2	6	8¾ x 10½	1050	850	GM	....	A-E	T	F	136	52	112*	23800
8-498	D	M-S	2	8	8¾ x 10½	1400	850	GM	....	A-E	T	F	159	60	112*	28000
12-498	D	M-S	2	12	8¾ x 10½	2100	850	GM	....	A-E	T	F	193	66	112*	36500
16-498	D	M-S	2	16	8¾ x 10½	2800	850	GM	....	A-E	T	F	234	66	121*	44600
6-567C	D	M-S	2	6	8½ x 10	600	800	GM	....	A-E	....	F	124	65	112*	15100
8-567C	D	M-S	2	8	8½ x 10	800	800	GM	....	A-E	....	F	140	63	112*	18300
12-567C	D	M-S	2	12	8½ x 10	1200	800	GM	....	A-E	....	F	175	65	112*	27800
16-567C	D	M-S	2	16	8½ x 10	1600	800	GM	....	A-E	....	F	214	63	112*	32500
16-358H	B	M-S	2	16	12½ x 14½	3300	600	....	B	E	....	F	197	126	113*	86500

Dimensions and weights are for basic engines. *F Falk reverse-reduction gear.* ** Height is over-all engine height.*

General Motors Corporation
Detroit Diesel Engine Division
Detroit, Michigan

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
2-71	A	S-P	2	2	4.25 x 5	48	1800	O	....	E-HY	M**	....	31	28	40	960
4-51	A	M-S-P	2	4	4.1 x 4.1	54–87	2200–3000	O	....	E	M**	P	39	28	34	1300
3-71	A	M-S-P	2	3	4.25 x 5	75–101	1800–2100	O	....	E-HY	M**	O	37	29	41	1525
4-71	A	M-S-P	2	4	4.25 x 5	101–144	1800–2100	O	....	E-HY	M**	O	43	29	42	1780
4-71†	A	M	2	4	4.25 x 5	95–151	1800–2300	O	....	E	M**	O	59	35	33	1920

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
6-71	A	M-S-P	2	6	4.25 x 5	154-223	1800-2100	O	....	E-HY	M**	O	64	29	43	2190
6-71†	A	M	2	6	4.25 x 5	147-235	1800-2300	O	....	E	M**	O	71	38	34	2270
Twin 4-71	A	S-P	2	8	4.25 x 5	202	1800	O	....	E-HY	M**	....	83	56	58	4820
Twin 6-71	A	M-S-P	2	12	4.25 x 5	308-447	1800-2100	O	....	E-HY	M**	O	95	56	58	5620
Twin 6-71*	A	M	2	12	4.25 x 5	295-447	1800-2100	O	....	E	M**	O	129	38	56	7550
Quad 6-71	A	M-S-P	2	24	4.25 x 5	616-893	1800-2100	O	....	E-HY	M**	O	128	57	53	12850
6-110	A	M-S-P	2	6	5 x 5.6	210-289	1800-2000	O	....	E-HY	M**	O	69	32	49	2960
Twin 6-110	A	S-P	2	12	5 x 5.6	416	1800	O	....	E-HY	M**	....	123	66	87	11440
Twin 6-110*	A	M	2	12	5 x 5.6	440-578	1800-2000	O	....	E	M**	O	146	62	69	11000

** Tandem arrangement. ** Pressure Scavenging. † Inclined engine. Weights and dimensions are given for industrial ("S" & "P") units except on engines indicated as solely for marine application. Where a horsepower range is shown, high end is "Rated" (not continuous) brake horsepower for applications such as pleasure craft, fire boats and other intermittent operation. Weights and dimensions for marine engines vary with gear selected and on "Twins" and "Quads", radiators and power take-offs are included. Torque converters are available with industrial models.*

Electro-Motive Division, General Motors Corporation
LaGrange, Illinois

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
6-567C	C	S-P	2	6	8½ x 10	540-600	720-800	O	....	E	....	....	126	65	89	18000
8-567C	C	S-P	2	8	8½ x 10	720-900	720-835	O	....	E	....	....	142	63	89	18000
12-567C	C	S-P	2	12	8½ x 10	1080-1200	720-800	O	....	E	....	....	156	65	89	25000
16-567C	C	S-P	2	16	8½ x 10	1440-1750	720-835	O	....	E	....	....	215	63	89	31500

Engines are available for Marine use through Cleveland Diesel Engine Division, General Motors Corporation.

Gray Marine Motor Company
710 Canton Avenue, Detroit 7, Michigan

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
4-D129	A	M	4	4	3¼ x 3½	25	2000	R	....	E	....	S-P	45	24	28	656
4-D157	A	M	4	4	3⅝ x 4½	30	1800	B	....	E	....	T-S	50	26	27	1100
4-D260	A	M	4	4	3⅞ x 5½	50	1800	B	....	E	....	T-S	58	22	36	1400
6-D427	A	M	4	6	4¼ x 4½	100	2200	B	....	E	....	P-S	61	32	35	1475
6-D572	A	M	4	6	4¾ x 5½	135	2200	B	....	E	....	T-S	72	23	40	2400

All data is for complete marine units.

Hallett, Diesel Engine Division
American M. A. R. C., Inc.
1601 W. Florence Avenue, Inglewood, California

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
AC1	A	S	4	1	3½ x 3½	5.5	1800	B	....	H-E*	....	....	27	15	24	220
AC2	A	S	4	2	3½ x 3½	13	1800	B	....	H-E*	....	....	34	25	25	350
D1	A	M-S	4	1	3⅞ x 4¼	8	1500	B	....	H-E*	....	S	24	20	36	450
D2	A	M-S	4	2	3⅞ x 4¼	18	1500	B	....	E	....	S	32	23	32	566
WC1	A	S	4	1	3½ x 3½	6.5	1800	B	....	H-E*	....	....	27	15	24	250
WC2	A	M-S	4	2	3½ x 3¾	12-13	1800	B	....	H-E*	....	S	34	25	25	375
WC4S	A	M-S	4	4	3½ x 3¾	28	1800	B	....	E	....	S	32	27	28	535

*Engines have open combustion chamber. * Model designation refers to hand starting—"S" is added to indicate electric starting; "M" indicates marine adaption. Dimensions and weights are for basic engine.*

P & H Diesel Engine Division, Harnischfeger Corporation
500 South Main Street, Crystal Lake, Illinois

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
287C-18	A	M-P	2	2	4½ x 5½	58	1800	B-D-S	....	E	M	S-T-W	33	29	41	1030
387C-18	A	M-P	2	3	4½ x 5½	90	1800	B-D-S	....	E	M	S-T-W	39	29	41	1350
487C-18	A	M-P	2	4	4½ x 5½	128	1800	B-D-S	....	E	M	S-T-W	46	29	41	1530
687C-18	A	M-P	2	6	4½ x 5½	180	1800	B-D-S	....	E	M	S-T-W	60	29	41	1900

Weights shown are for "P" units.

Hercules Motors Corporation
Canton, Ohio

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
DIX42	A	M-S-P	4	1	3½ x 4	12	2200	R-B	....	E	....	....	18	21	30	325
DIX83	A	M-S-P	4	2	3½ x 4	24¼	2200	R-B	....	E	....	....	22	22	31	400
DIXC	A	M-S-P	4	2	4 x 4½	27.6	1800	B	....	E	....	....	22	20	21	550
DIXD	A	M-S-P	4	2	4¼ x 4½	30	1800	B	....	E	....	....	22	20	21	550
DIX4B	A	M-S-P	4	4	3¼ x 4	38.5	2200	B	....	E	....	....	31	22	19	600
DIX4D	A	M-S-P	4	4	3½ x 4	48.5	2200	R-B	....	E	....	....	31	22	19	600
DD173	A	M-S-P	4	4	3½ x 4½	46.3	1800	R-B	....	E	....	....	31	22	33	600
DIX4E	A	M	4	4	3¾ x 4	75	3000	..	....	E	....	....	45	28	21	890
DIX4ES	A	M	4	4	3¾ x 4	95	3000	..	....	E	M	....	45	32	21	990
DOOB	A	M-S-P	4	4	3⅝ x 4½	48	1800	R-B	....	E-G	....	....	30	23	20	750
DD198	A	M-S-P	4	4	3¾ x 4½	53.2	1800	R-B	....	E	....	....	31	22	33	600
DOOC	A	M-S-P	4	4	4 x 4½	55	1800	B	....	E-G	....	....	30	23	20	750
DD226	A	M-S-P	4	4	4 x 4½	60.5	1800	R-B	....	E	....	....	31	22	33	600
DOOD	A	M-S-P	4	4	4¼ x 4½	61.5	1800	R-B	....	E-G	....	....	30	23	20	750
DIX6D	A	M-S-P	4	6	3⅝ x 4	77.5	2200	R-B	....	E-G	....	....	39	24	19	800
DD260	A	M-S-P	4	6	3½ x 4½	69.5	1800	R-B	....	E	....	....	40	22	36	750

(Specifications continued on next page)

Hercules *(Continued from preceding page)*

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
DIX6-272	A	M-S-P	4	6	3 11/16 x 4 1/4	85	2200	R-B	....	A-E-G	....	....	39	24	38	800
DIX6E	A	M	4	6	3 3/4 x 4	115	3000	..	....	E	....	....	54	31	21	1380
DIX6E8	A	M	4	6	3 3/4 x 4	150	3000	..	....	E	M	....	54	34	21	1490
DJXB	A	M-S-P	4	6	3 1/2 x 4 1/2	60	1800	R-B	....	A-E-G	....	....	37	23	21	950
DJXC&H	A	M-S-P	4	6	3 3/4 x 4 1/2	69-79	1800	R-B	....	A-E-G	....	....	37	28	21	950
DJ298	A	M-S-P	4	6	3 1/2 x 4 1/2	79	1800	R-B	....	E	....	....	40	22	36	750
DJXHF	A	M-S-P	4	6	3 3/4 x 4 1/2	79	1800	R-B	....	A-E-G	....	....	39	34	13 x 11	950
DJ339	A	M-S-P	4	6	4 x 4 1/2	91	1800	R-B	....	E	....	....	40	22	36	750
DWXC	A	M-S-P	4	6	4 x 4 3/4	94	1800	R-B	....	A-E-G	....	....	41	27	24	1350
DWXD	A	M-S-P	4	6	4 1/4 x 4 3/4	107	1800	R-B	....	A-E-G	....	....	41	27	24	1350
DWXLD	A	M-S-P	4	6	4 1/4 x 5	112	1800	R-B	....	A-E-G	....	....	41	27	25	1350
DWXLDF	A	M-S-P	4	6	4 1/4 x 5	106	1800	R-B	....	A-E-G	....	....	37	37	9 x 9	1325
DWXE	A	M	4	6	4 3/4 x 4 3/4	148	2600	..	....	E	....	....	67	33	24	2200
DWXETS	A	M	4	6	4 3/4 x 4 3/4	198	2600	..	....	E	T	....	67	33	24	2400
DRXB	A	M-S-P	4	6	4 3/4 x 5 1/4	106	1600	R-B	....	A-E-G	....	....	45	26	25	1600
DRX-601	A	M-S-P	4	6	4 1/2 x 5 1/4	113	1600	R-B	....	A-E-G	....	....	47	26	39	1600
DRX-601-TS	A	M-S-P	4	6	4 1/2 x 5 1/4	144	1600	R-B	....	A-E-G	T	....	50	28	51	1700
DRXC	A	M-S-P	4	6	4 3/4 x 5 1/4	118	1600	R-B	....	A-E-G	....	....	45	26	25	1600
DFXB	A	M-S-P	4	6	5 x 6	160	1600	R-B	....	A-E-G	....	....	56	30	31	2500
DFXC	A	M-S-P	4	6	5 1/4 x 6	176	1600	R-B	....	A-E-G	....	....	56	30	31	2500
DFXD	A	M-S-P	4	6	5 1/2 x 6	191	1600	R-B	....	A-E-G	....	....	56	30	31	2500
DFXE	A	M-S-P	4	6	5 3/4 x 6	199	1600	R-B	....	A-E-G	....	....	56	30	31	2500
DFXETS	A	M-S-P	4	6	5 3/4 x 6	258-318	1600-2000	R-B	....	A-E-G	T	....	75	28	52	2700
DFXH	A	M-S-P	4	6	5 3/4 x 6	220-260	1600-2100	R-B	....	A-E-G	....	....	56	30	32	2600
DFXH-TS	A	M-S-P	4	6	5 3/4 x 6	267	1600	R-B	....	A-E-G	T	....	73	30	47	2700
DFXHF	A	M-S-P	4	6	5 3/4 x 6	220	1600	R-B	....	A-E-G	....	....	51	49	18 x 16	2600
DIXV8-402	A	S-P	4	V-8	4 x 4	127	2200	R	....	A-E	....	....	39	33	20	1050
DNXV8D	A	M-S-P	4	V-8	6 1/4 x 6	325-388	1600-2000	B	....	A-E-G	....	....	52	42	32	4200
DNXV8DTS	A	M-S-P	4	V-8	6 1/4 x 6	410-500	1600-1800	B	....	A-E-G	T	....	76	42	73	5000
BXB	B	S-P	4	2	2 7/8 x 3	7.7	1800	..	B-HM	H-E	....	....	19	17	17	131
NXA	B	S-P	4	2	3 x 4	10.5	1800	..	B-HM	H-E	....	....	21	18	19	270
NXB	B	S-P	4	2	3 1/4 x 4	12.5	1800	..	B-HM	H-E	....	....	21	18	19	270
ZXA	B	S-P	4	4	2 1/2 x 3	14.7	2500	..	B-HM	H-E	....	....	24	17	17	179
ZXB	B	S-P	4	4	2 5/8 x 3	15.7	2500	..	B-HM	H-E	....	....	24	17	17	179
IXA	B	S-P	4	4	3 x 4	22.1	1800	..	B-HM	H-E	....	....	27	18	20	285
IXB	B	S-P	4	4	3 1/4 x 4	26.4	1800	..	B-HM	H-E	....	....	27	18	20	293
IXLB	B	S-P	4	4	3 1/4 x 4 1/2	28	1800	..	B-HM	H-E	....	....	27	18	20	293
JX4E	B	S-P	4	4	3 1/2 x 4 1/2	34.8	1800	..	B-HM	H-E	....	....	32	21	25	470
GO-173	B	S-P	4	4	3 1/2 x 4 1/2	40	1800	..	B-HM	H-E	....	....	31	22	33	500
JX4C	B	S-P	4	4	3 3/4 x 4 1/2	40.2	1800	..	B-HM	H-E	....	....	32	21	25	470
GO-198	B	S-P	4	4	3 3/4 x 4 1/2	46.5	1800	..	B-HM	H-E	....	....	31	22	33	500
JX4D	B	S-P	4	4	4 x 4 1/4	45.5	1800	..	B-HM	H-E	....	....	32	21	25	470
GO-226	B	S-P	4	4	4 x 4 1/2	51.5	1800	..	B-HM	H-E	....	....	31	22	33	500
QXA	B	S-P	4	6	3 1/2 x 4 1/2	37.8	1800	..	B-HM	H-E	....	....	36	18	21	440
QXB	B	S-P	4	6	3 3/4 x 4 1/2	40.8	1800	..	B-HM	H-E	....	....	36	18	21	440
QXC	B	S-P	4	6	3 3/4 x 4 1/2	46	1800	..	B-HM	H-E	....	....	36	18	21	440
QXD	B	S-P	4	6	3 15/16 x 4 1/2	48.5	1800	..	B-HM	H-E	....	....	36	18	21	440
QXLD	B	S-P	4	6	3 15/16 x 4 1/4	54.5	1800	..	B-HM	H-E	....	....	36	18	21	440
JXE	B	S-P	4	6	3 1/2 x 4 1/2	52.7	1800	..	B-HM	H-E	....	....	39	21	30	590
GO-260	B	S-P	4	6	3 1/2 x 4 1/2	60.5	1800	..	B-HM	H-E	....	....	40	22	34	650
JXB	B	S-P	4	6	3 3/4 x 4 1/2	55.2	1800	..	B-HM	H-E	....	....	39	19	25	606
JXC	B	S-P	4	6	3 3/4 x 4 1/2	60.4	1800	..	B-HM	H-E	....	....	39	19	25	606
GO-298	B	S-P	4	6	3 3/4 x 4 1/2	69	1800	..	B-HM	H-E	....	....	40	22	34	650
JXD	B	S-P	4	6	4 x 4 1/4	69.7	1800	..	B-HM	H-E	....	....	39	19	25	606
JXLD	B	S-P	4	6	4 x 4 1/2	77.6	1800	..	B-HM	H-E	....	....	39	19	25	630
GO-339	B	S-P	4	6	4 x 4 1/2	78	1800	..	B-HM	H-E	....	....	40	22	34	650
WXC3	B	S-P	4	6	4 1/4 x 4 1/2	86	1800	..	B-HM	H-E-A	....	....	43	24	29	820
WXLC	B	S-P	4	6	4 x 4 3/4	79	1800	..	B-HM	H-E-A	....	....	43	27	29	811
WXLC3	B	S-P	4	6	4 1/4 x 4 3/4	89	1800	..	B-HM	H-E-A	....	....	43	27	29	825
TDXB	B	S-P	4	6	4 3/4 x 5 1/4	106	1800	..	B-HM	H-E-A	....	....	48	28	35	1220
TDXC	B	S-P	4	6	4 1/2 x 5 1/4	111	1800	..	B-HM	H-E-A	....	....	48	28	35	1220
RXB	B	S-P	4	6	4 1/2 x 5 1/4	98.5	1800	..	B-HM	H-E-A	....	....	47	27	33	1000
RXC & LC	B	S-P	4	6	4 3/4 x 5 1/4	104-110.5	1800	..	B-HM	H-E-A	....	....	47	27	33	1010
RXLD & H	B	S-P	4	6	4 3/4 x 5 1/4	116.5-125	1800	..	B-HM	H-E-A	....	....	47	26	36	1195
HXB	B	S-P	4	6	5 x 6	120	1600	..	B-HM	H-E-A	....	....	56	30	41	1810
HXC	B	S-P	4	6	5 1/4 x 6	132.5	1600	..	B-HM	H-E-A	....	....	56	30	41	1810
HXD	B	S-P	4	6	5 1/2 x 6	155	1600	..	B-HM	H-E-A	....	....	56	30	41	1810
HXE	B	S-P	4	6	5 3/4 x 6	176	1600	..	B-HM	H-E-A	....	....	56	30	41	1830

Engines have turbulence-chamber combustion system. Lengths measured from bellhousing face to front support. Heights measured from crankshaft to top of cylinder head cover. Weights are approximate and include engine with fuel handling equipment only and no other accessories not forming an integral part of the engine. Various mounting arrangements, flywheel housings, oil pans, manifolds, starting motor and generator locations are available to meet specific applications requirements.

Ingersoll-Rand Company
11 Broadway, New York 4, N. Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
T	A	M-S-P	4	6	7 x 8 1/2	220	1000	O	....	A-E	....	*	86	45	69	....
T	A	M-S-P	4	8	7 x 8 1/2	290	1000	O	....	A-E	....	*	108	45	69	....
TS	A	M-S-P	4	6	7 x 8 1/2	350	1000	O	....	A-E	T	*	86	48	69	....
TS	A	M-S-P	4	8	7 x 8 1/2	465	1000	O	....	A-E	T	*	108	48	69	....
S	A	M-S-P	4	5	10 1/2 x 12	375	750	O	....	A-E	....	*	116	49	85	....
S	A	M-S-P	4	6	10 1/2 x 12	450	750	O	....	A-E	....	*	132	49	85	....
S	A	M-S-P	4	7	10 1/2 x 12	525	750	O	....	A-E	....	*	149	49	85	....
S	A	M-S-P	4	8	10 1/2 x 12	600	750	O	....	A-E	....	*	165	49	85	....
SS	A	M-S-P	4	5	10 1/2 x 12	580	750	O	....	A-E	T	*	116	53	85	....
SS	A	M-S-P	4	6	10 1/2 x 12	750	750	O	....	A-E	T	*	132	53	85	....
SS	A	M-S-P	4	7	10 1/2 x 12	825	750	O	....	A-E	T	*	149	53	85	....
SS	A	M-S-P	4	8	10 1/2 x 12	1000	750	O	....	A-E	T	*	165	53	85	....

* Reverse & Reduction Gear varies.

International Harvester Co.
180 No. Michigan Avenue, Chicago 1, Illinois

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
UD-264	A	S-P	4	4	4 x 5 1/4	55	1800	O	....	E-G	....	....	38	25	47	1800
UD-350	A	S-P	4	4	4 1/2 x 5 1/2	75	1800	O	....	E-G	....	....	40	27	54	2073
UD-14A	A	S-P	4	4	4 5/8 x 6 1/2	100	1800	O	....	E-G	....	....	52	33	57	2642
UD-525	A	S-P	4	6	4 1/2 x 5 1/2	115	1800	O	....	E-G	....	....	68	36	57	3127
UD-18A	A	S-P	4	6	4 5/8 x 6 1/2	150	1800	O	....	E-G	....	....	72	36	60	3840
UD-1091	A	S-P	4	6	5 5/8 x 7	190	1400	O	....	E-G	....	....	84	44	72	5480
U-1091	B	S-P	4	6	5 3/4 x 7	200	1600	..	B	E	....	....	84	44	72	5615

Diesel engines: Horsepower shown is for complete power unit with radiator & fan as obtained at sea level with regular production injection pump setting. Dimensions and weights from front of radiator to back face of flywheel housing and do not include power take-off attachment.

Kahlenberg Brothers Company
1707-12th Street
Two Rivers, Wisconsin

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
AD	A	M-S	2	2	8½ x 9	30–36	400	O	....	A	....	O	...	...	...	5450
AT	A	M-S	2	3	8½ x 9	45–54	400	O	....	A	....	O-D	...	...	...	6500
AF	A	M-S	2	4	8½ x 9	60–70	400	O	....	A	....	O-D	...	...	...	8200
BD	A	M-S	2	2	10 x 10½	50–60	375	O	....	A	....	O	...	...	...	7300
BT	A	M-S	2	3	10 x 10½	90	375	O	....	A	....	†D	...	...	...	9700
BF	A	M-S	2	4	10 x 10½	120	375	O	....	A	....	†D	...	...	...	11980
B5	A	M-S	2	5	10 x 10½	150	375	O	....	A	....	†D	...	...	...	15650
B6	A	M-S	2	6	10 x 10½	180	375	O	....	A	....	D	...	...	...	17050
CT	A	M-S	2	3	12½ x 14	150	325	O	....	A	....	†D	...	...	...	21730
CF	A	M-S	2	4	12½ x 14	200	325	O	....	A	....	†D	...	...	...	23900
C5	A	M-S	2	5	12½ x 14	250	325	O	....	A	....	D	...	...	...	29000
C6	A	M-S	2	6	12½ x 14	300	325	O	....	A	....	D	...	...	...	34000
E4	A	M-S	2	4	10½ x 16	400–532	300–400	..	....	A	T	†D	115	76	79	22000
E5	A	M-S	2	5	10½ x 16	500–665	300–400	..	....	A	T	D	130	76	79	26000
E6	A	M-S	2	6	10½ x 16	600–800	300–400	..	....	A	T	D	146	76	79	30000
E7	A	M-S	2	7	10½ x 16	700–930	300–400	..	....	A	T	D	162	76	79	34000
E8	A	M-S	2	8	10½ x 16	800–1032	300–400	..	....	A	T	D	177	76	79	38000

† *Reduction gear optional.*

The Lathrop Engine Company
Mystic, Conn.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
D-60	A	M	4	4	5½ x 7	60	900	B	....	E	....	O	75	29	31	3000
D-120	A	M	4	6	5½ x 7	120	1100	B	....	E	....	S	108	31	31	4100
DFXH	A	M	4	6	5¾ x 6	187	1600	B	....	E	....	C	88	38	36	4230
DNX-V8DTS	A	M	4	8	6¼ x 6	355	1600	B	....	E	M	C	98	45	51	7740
DIX-4E	A	M	4	4	3¾ x 4	58	2800	B	....	E	....	P	54	23	23	950
DIX-4ES	A	M	4	4	3¾ x 4	74	2800	B	....	E	M	P	55	24	21	1050
DIX-6E	A	M	4	6	3¾ x 4	88	2800	B	....	E	....	P	66	24	23	1440
DIX-6ES	A	M	4	6	3¾ x 4	113	2800	B	....	E	M	P	66	23	23	1550

LeRoi Division
Westinghouse Air Brake Co.
1706 South 68th Street, Milwaukee 14, Wisconsin

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
D201	B	S-P	4	4	4 x 4	35	1800	..	HM*	E-H	....	....	54	25	48	850
D226	B	S-P	4	4	4 x 4½	40.5	1800	..	HM*	E-H	....	....	54	25	48	850
A288	B	S	4	1	7¼ x 7	17	720	..	HM*	E-H	....	....	64	47	54	2300†
A114	B	S	4	1	5¼ x 5¼	11.9	1200	..	HM*	E-H	....	....	47	49	51	1530†
H540	B	S-P	4	8	4½ x 4¼	140	2400	..	HM*	E-A	....	....	81	40	64	2000†
H844	B	S-P	4	8	5¼ x 4¾	190	2200	..	HM*	E-A	....	....	88	50	74	3200†
F1500	B	S-P	4	6	6¾ x 7	159	1100	..	HM**	G-A-E	....	....	115	50	84	5800
H2000	B	S	4	8	6¾ x 7	213	1100	..	HM**	G-A-E	....	....	88	52	72	5850
L8000	B	S	4	12	6¾ x 7	324	1100	..	HM**	G-A-E	....	....	111	60	84	8300
L8460	B	S	4	12	7¼ x 7	445	1200	..	HM**	G-A-E	....	....	167	66	86	12800
L4000	B	S	4	12	7.54 x 7.5	493	1200	..	HM**	G-A-E	....	....	169	66	91	12850

* *Distributor available.* ** *LM available.* † *Lighter automotive units available. Weights are given for stationary units (dry).*

Lufkin Foundry & Machine Co.,
Lufkin, Texas

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
H833	B	S	2	2	5¼ x 7	20–30	425–650	..	HM	E-A	....	....	59	53	52	2900
H796	B	S	2	2	7½ x 9	45–65	400–600	..	HM	E-A	....	....	76	68	60	4250

Mack Motor Truck Corporation
Plainfield, New Jersey

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
END673	A	P	4	6	4⅞ x 6	170	2100	B	....	E-A	....	....	51	27	45	1917
ENDT673	A	P	4	6	4⅞ x 6	205	2100	B	....	E-A	T	....	51	31	45	1968

Minneapolis-Moline Company
Minneapolis 1, Minnesota

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
206H-4	B	S-P	4	4	3½ x 5	32	1550	..	B-H-M	E	....	T-C*	38	21	36	900
283-4	D	S-P	4	4	4½ x 5	44.8	1400	B	B-H-M	E	....	T-C*	46	25	46	1400
403-4	B	S-P	4	4	4½ x 6	57.6	1300	..	B-H-M	E	....	T-C*	46	25	46	1590
425-6	D	S-P	4	6	4½ x 5	66.4	1400	B	B-H-M	E	....	T-C*	60	25	48	2100
605-6	D	S-P	4	6	4½ x 6	84	1300	B	B-H-M	E	....	T-C*	60	29	54	2500
800-6	B	S-P	4	6	5½ x 6	118	1300	..	B-H-M	E	....	T-C*	60	29	54	3125
1210-12	B	S-P	4	12	4½ x 6	160	1300	..	B-H-M	E	....	T-C*	112	49	72	5800
1600-12	B	S	4	12	5½ x 6	233	1300	..	B-H-M	E	....	T-C*	112	49	72	6800

Note: Type "B" engine includes gasoline, natural gas, LPG and tractor fuel **Optional.*

Murphy Diesel Company
5317 West Burnham Street, Milwaukee, Wisconsin

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
ME4	A	P-M	4	4	5¾ x 6½	96	1200	O	....	E-GA	....	....	71	43	65	3800
11	A	P-M	4	4	5¾ x 6½	107-133	1200-1400	O	....	E-GA	*	....	71	43	65	3800-3850
12	A	P-M	4	4	6 x 6½	117-144	1200-1400	O	....	E-GA	*	....	71	43	65	3800-3850
20	C	P-M	4	6	5½ x 6½	144-157	1200-1400	O	....	E-GA	....	....	93	43	65	4700
120	A	P-M	4	6	5½ x 6½	155-170	1200-1400	O	....	E-GA	*	....	93	43	65	4800
21	C	P-M	4	6	5¾ x 6½	161-173	1200-1400	O	....	E-GA	....	....	93	43	65	4700
22	C	P-M	4	6	6 x 6½	177-205	1200-1400	O	....	E-GA	....	....	93	43	65	4700
121	A	P-M	4	6	5¾ x 6½	182-197	1200-1400	O	....	E-GA	*	....	93	43	65	4800
122	A	P-M	4	6	6 x 6½	192-220	1200-1400	O	....	E-GA	*	....	93	43	65	4800
24	C	P-M	4	6	6⅛ x 6½	198-216	1200-1400	O	....	E-GA	....	....	93	43	65	4700
324	A	P-M	4	6	6⅛ x 6½	225-243	1200-1400	O	....	E-GA	*	....	93	43	65	4800

** Tubo-supercharging manifold. All engines have open-type combustion chambers and unit injectors. Marine engines carry different model numbers, weights and dimensions. Ratings shown are with power consuming accessories and corrected to 29.92-in & 60°F.*

Nordberg Manufacturing Company
Milwaukee, Wisconsin

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
4FS-1	A	S-M-P	4	1	4½ x 5¼	10-15	1200-1800	B	....	E-H	....	....	....	....	....	.....
4FG-1	B	S	4	1	4½ x 5¼	8-18	800-1800	....	HM	E-H	....	....	....	....	....	.....
4FS-2	A	S-M-P	4	2	4½ x 5¼	20-30	1200-1800	B	....	E-H	....	....	....	....	....	.....
4FG-2	B	S	4	2	4½ x 5¼	16-36	800-1800	....	HM	E-H	....	....	....	....	....	.....
4FS-3	A	S-M-P	4	3	4½ x 5¼	30-45	1200-1800	B	....	E-H	....	....	....	....	....	.....
FS-96-HSC*	D	M-S	4	6	9 x 11½	640	720	S	LM	A	T	D	....	....	....	.....
FS-98-HSC*	D	M-S	4	8	9 x 11½	850	720	S	LM	A	T	D	....	....	....	.....
FS-135-HSC*	D	S	4	5	13 x 16½	1000-1350	450-514	S	P	A	T	....	....	....	....	.....
FS-136-HSC*	D	M-S	4	6	13 x 16½	1200-1900	450-600	S	P	A	T	D	....	....	....	.....
FS-137-HSC*	D	M-S	4	7	13 x 16½	1400-1900	450-514	S	P	A	T	D	....	....	....	.....
FS-158-HSC*	D	M-S	4	8	13 x 16½	1600-2500	450-600	S	P	A	T	D	....	....	....	.....
FS-1310-HSC*	D	M-S	4	10	13 x 16½	2000-2700	450-514	S	P	A	T	D	....	....	....	.....
FS-1312-HSC*	D	M-S	4	12	13 x 16½	2400-3800	450-600	S	P	A	T	D	....	....	....	.....
FS-1316-HSC*	D	M-S	4	16	13 x 16½	3200-5000	450-600	S	P	A	T	D	....	....	....	.....
RTS**-1412	D	M-S	2	12	14 x 16	2125-2520	400-450	R	P	A	....	....	....	....	....	.....
TS-215-31	C	M-S	2	5	21½ x 31	2550-2925	240-257	R	....	A	....	D	....	....	....	.....
TS-216-31	C	M-S	2	6	21½ x 31	3050-3500	240-257	R	....	A	....	D	....	....	....	.....
TS-217-31	C	M-S	2	7	21½ x 31	3575-4100	240-257	R	....	A	....	D	....	....	....	.....
TS-218-31	C	M-S	2	8	21½ x 31	4075-4675	240-257	R	....	A	....	D	....	....	....	.....
TS-219-31	C	M-S	2	9	21½ x 31	4600-5275	240-257	R	....	A	....	D	....	....	....	.....
TS-2110-31	C	M-S	2	10	21½ x 31	5100-5850	240-257	R	....	A	....	D	....	....	....	.....
TS-2112-31	C	M-S	2	12	21½ x 31	6150-7025	240-257	R	....	A	....	D	....	....	....	.....
TS-295	C	M-S	2	5	29 x 40	4500-5300	180-200	R	....	A	....	D	....	....	....	.....
TS-296	C	M-S	2	6	29 x 40	5400-6400	180-200	R	....	A	....	D	....	....	....	.....
TS-297	C	M-S	2	7	29 x 40	6300-7500	180-200	R	....	A	....	D	....	....	....	.....
TS-298	C	M-S	2	8	29 x 40	7200-8500	180-200	R	....	A	....	D	....	....	....	.....
TS-299	C	M-S	2	9	29 x 40	8100-9600	180-200	R	....	A	....	D	....	....	....	.....
TS-2910	C	M-S	2	10	29 x 40	9000-10600	180-200	R	....	A	....	D	....	....	....	.....
TS-2912	C	M-S	2	12	29 x 40	10800-12800	180-200	R	....	A	....	D	....	....	....	.....

* Supairthermal execution. ** Radial engine. Engines are designed to operate continuously at ratings s...wn and are good for 10 per cent overload for 2 hr in any 24 hr period

Oliver Corporation
400 W. Madison St., Chicago, Illinois

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
166D	C	S-M-P	4	4	3½ x 3¾	29 6	1800	B	....	E	....	*	31	22	29	712
177D	C	S-M-P	4	6	3½ x 3¾	38 6	1800	B	....	E	....	*	40	22	30	863
188D	C	S-M-P	4	6	3¾ x 4	48	1800	B	....	E	....	*	43	22	55	1032
199D	C	S-M-P	4	6	4 x 4	57	1800	B	....	E	....	*	41	22	55	1100
166HC	B	S-P	4	4	3½ x 3¾	29 6	1800	....	B-HM	E	....	*	31	22	29	705
177HC	B	S-P	4	6	3½ x 3¾	38 6	1800	....	B-HM	E	....	*	40	22	30	779
188HC	B	S-P	4	6	3¾ x 4	48	1800	....	B-HM	E	....	*	43	22	55	1048
199HC	B	S-P	4	6	4 x 4	57	1800	....	B-HM	E	....	*	44	22	55	1165

**Reverse Gear Available*

Rathbun-Jones Engineering Company
Toledo, Ohio

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
18	C	S	4	3	11 x 18	220	450	O	....	A	....	....	158	70	106	26000
18	C	S	4	4	11 x 18	290	450	O	....	A	....	....	177	70	106	31500
18	C	S	4	5	11 x 18	364	450	O	....	A	....	....	196	70	106	36300
18	C	M-S	4	6	11 x 18	435	450	O	....	A	....	D	215	70	106	41200
18	C	M-S	4	7	11 x 18	510	450	O	....	A	....	D	238	70	106	46000
18	C	M-S	4	8	11 x 18	580	450	O	....	A	....	D	258	70	106	51000
22	C	S	4	3	15½ x 22	388	327	O	....	A	....	....	175	80	126	41500
22	C	S	4	4	15½ x 22	518	327	O	....	A	....	....	197	80	126	50000
22	C	S	4	5	15½ x 22	650	327	O	....	A	....	....	225	80	126	58500
22	C	M-S	4	6	15½ x 22	775	327	O	....	A	....	D	247	80	126	68000
22	C	M-S	4	7	15½ x 22	910	327	O	....	A	....	D	271	80	126	75500
22	C	M-S	4	8	15½ x 22	1035	327	O	....	A	....	D	293	80	126	85000
24	C	S	4	3	18¼ x 24	540	300	O	....	A	....	....	200	85	140	60000
24	C	S	4	4	18¼ x 24	720	300	O	....	A	....	....	231	85	140	74000
24	C	S	4	5	18¼ x 24	900	300	O	....	A	....	....	258	85	140	87000
24	C	M-S	4	6	18¼ x 24	1080	300	O	....	A	....	D	294	85	140	98000
24	C	M-S	4	7	18¼ x 24	1260	300	O	....	A	....	D	321	85	140	110000
24	C	M-S	4	8	18¼ x 24	1440	300	O	....	A	....	D	348	85	140	120000
28	C	S	4	5	19½ x 28	1025	257	O	....	A	....	....	332	104	171	140000
28	C	M-S	4	6	19½ x 28	1230	257	O	....	A	....	D	339	104	171	164000
28	C	M-S	4	7	19½ x 28	1435	257	O	....	A	....	D	380	104	171	187000
28	C	M-S	4	8	19½ x 28	1640	257	O	....	A	....	D	409	104	171	212000
28	C	S	4	10	19½ x 28	2050	257	O	....	A	....	....	460	104	171	230000
28	C	S	4	12	19½ x 28	2460	257	O	....	A	....	....	528	104	171	260000

Engines have Price turbulence chamber combustion system and Rathbun distributor type fuel injection system. Lengths listed are approximate for stationary engines and include generator, exciter drive and outboard bearing. Widths include operating platforms. Marine lengths, including thrust bearing, are considerably shorter. Weights are for stationary units.

R. H. Sheppard Company, Inc.
Hanover, Pennsylvania

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
17	A	M-S-P	4	2	3¼ x 4	13.5	1800	O	....	E	....	†	33	22	31	550
13	A	M-S-P	4	2	4 x 5	20	1800	O	....	E	....	†	43	24	49	1365
6	A	M-S-P	4	3	4 x 5	30	1800	O	....	E	....	†	55	26	51	1662
16	A	M-S-P	4	4	4½ x 5	51.4	1800	O	....	E	....	†	65	22	46	1725

† *Reverse gear optional. Weights & dimensions are for "S" & "P" units.*

Sterling Engine Company, IInc.
Menominee, Michigan

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
AB-6	A	M-S	4	6	4½ x 5⅝	72-110	1400-1800	B	....	E	....	S	58	30	53	3150
DB-6	A	M-S	4	6	5½ x 7	114-170	1200-1500	B	....	E	....	S	60	36	60	5200
DB-8	A	M-S	4	8	5½ x 7	152-230	1200-1500	B	....	E	....	S	75	36	60	6850
VD-6	A	M-S	4	6	8 x 9	420	1200	B-S	....	A-E	....	S-T	95	40	64	8500
VD-6-S	A	M-S	4	6	8 x 9	750	1200	B	....	A-E	T	S	115	40	64	9160
VD-8-S	A	S	4	8	8 x 9	1000	1200	B	....	A-E	T	....	136	40	64	12450
LC-6	B	S	4	6	5¼ x 6	72-110	800-2000	..	B	E	....	....	57	33	42	2200
TC-6	B	S	4	6	8 x 9	260-450	700-1200	..	B	A-E	....	....	101	45	64	6900
TC-8	B	S	4	8	8 x 9	365-600	700-1200	..	B	A-E	....	....	122	45	64	9000

Weights and dimensions are given for "S" units. Horsepower listings indicate continuous and intermittent ratings.

Union Diesel Engine Co.,
Oakland, Calif.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
GA6	D	M-S	4	6	8½ x 11	175-225	475-600	O	....	A	....	D	144	34	72	14000
GA6S	D	M-S	4	6	8½ x 11	260-330	475-600	O	....	A	T	D	146	34	72	15000
L6	D	M-S	4	6	10 x 14	230-340	350-514	O	....	A	....	D	175	42	85	23500
L6S	D	M-S	4	6	10 x 14	340-500	350-514	O	....	A	T	D	178	42	85	24500
P6	D	M-S	4	6	12 x 15	410-525	400-514	O	....	A	....	D	194	46	93	36500
P6S	D	M-S	4	6	12 x 15	600-700	400-514	O	....	A	T	D	194	46	93	38000
V6	D	M-S	4	6	14 x 19	560-700	325-400	O	....	A	....	D	242	57	114	58000
V6S	D	M-S	4	6	14 x 19	840-1020	325-400	O	....	A	T	D	242	57	114	60000
Z6	D	M-S	4	6	16 x 20½	600-750	240-300	O	....	A	....	D	275	62	125	87500
Z6S	D	M-S	4	6	16 x 20½	900-1125	240-300	O	....	A	T	D	285	62	125	90000
GA8	D	M-S	4	8	8½ x 11	235-300	450-600	O	....	A	....	D	178	34	72	18000
GA8S	D	M-S	4	8	8½ x 11	345-440	450-600	O	....	A	T	D	180	34	72	19000
L8	D	M-S	4	8	10 x 14	300-450	350-514	O	....	A	....	D	214	42	85	32000
L8S	D	M-S	4	8	10 x 14	450-660	350-514	O	....	A	T	D	217	42	85	33500
P8	D	M-S	4	8	12 x 15	550-700	400-514	O	....	A	....	D	235	46	93	46000
P8S	D	M-S	4	8	12 x 15	800-1040	400-514	O	....	A	T	D	239	46	93	48000
V8	D	M-S	4	8	14 x 19	750-925	325-400	O	....	A	....	D	292	57	114	74000
V8S	D	M-S	4	8	14 x 19	1125-1400	325-400	O	....	A	T	D	296	57	114	76000
Z8	D	M-S	4	8	16 x 20½	800-1000	240-300	O	....	A	....	D	347	62	125	112000
Z8S	D	M-S	4	8	16 x 20½	1200-1500	240-300	O	....	A	T	D	350	62	125	115000

Venn Severin Engine Works, Inc.
12822 Simms Ave., Hawthorne, Calif.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
HCL-2	A	M-S-P	2	2	7 x 8	60	900	B	....	AE	....	TS	47	35	62	3500
HCL-3	A	M-S-P	2	3	7 x 8	90	900	B	....	AE	....	TS	56	35	62	4500
308V4	A	M-S-P	2	V-4	7 x 8	180	1000	B	....	AE	....	TS	81	44	54	4800
308V6	A	M-S-P	2	V-6	7 x 8	270	1000	B	....	AE	....	TS	94	44	54	5500

Waukesha Motor Company
Waukesha, Wisconsin

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
ICK	B	S-P	4	4	2½ x 3½	12*	2000	..	B-HM	H-E	....	....	22	13	21	195
FC	B	S-P	4	4	3¼ x 4	26*	1800	..	B-HM	H-E	....	....	28	19	21	290
180GLB	B	S-P	4	4	3½ x 3⅝	32†*	2000	..	B-HM	H-E	....	....	31	19	28	450
180DLC	A	S-P	4	4	3½ x 3⅝	31*	2000	B	....	H-E	....	....	31	19	28	475
XAH	B	S-P	4	4	3⅝ x 4½	35*	1800	..	B-HM	H-E	....	....	33	19	27	385
185GLB	B	S-P	4	6	3½ x 3⅝	48*	2000	..	B-HM	H-E	....	....	31	22	30	675
185DLC	A	S-P	4	6	3½ x 3⅝	44*	2000	B	....	H-E	....	....	31	22	30	675
190GLB	B	S-P	4	6	3¾ x 4	58*	2000	..	B-HM	H-E	....	....	43	22	30	690
190DLCA	A	S-P	4	6	3¾ x 4	58†*	2000	B	....	H-E	....	....	43	22	29	868
195GL	B	S-P	4	6	4 x 4	65*	2000	..	B-HM	H-E	....	....	43	22	30	775
195DLCA	A	S-P	4	6	4 x 4	67†*	2000	B	....	E	....	....	43	26	30	965
195GK	B	S-P	4	6	4¼ x 4	71*	2000	..	B-HM	H-E	....	....	44	22	30	780
MZA	B	S-P	4	6	4¼ x 4¾	64*	1600	..	B-HM	H-E	....	....	44	21	34	920
135C-KB	B	S-P	4	6	4¼ x 5	93†*	2000	..	B-HM	E	....	....	47	26	38	1325
135DKB	A	S-P	4	6	4¼ x 5	99†*	2000	B	....	E	....	....	48	26	35	1386
135DKBS	A	S-P	4	6	4¼ x 5	121†*	2000	B	....	E	T	....	48	26	41	1486
135C-ZB	B	S-P	4	6	4¼ x 5	104†*	2000	..	B-HM	E	....	....	48	26	38	1325
140GKB	B	S-P	4	6	4½ x 5½	122†*	1800	..	B-HM	E	....	....	52	26	43	1390
145GKB	B	S-P	4	6	5¼ x 6	157†*	1800	..	B-HM	E-G	....	....	56	29	47	1810
148DKB	A	S-P	4	6	5¼ x 6	147†*	1800	B	....	E-G	....	....	56	29	47	2320
148DKBS	A	S-P	4	6	5¼ x 6	194†*	1800	B	....	E-G	T	....	56	29	56	2445
145GZB	B	S-P	4	6	5¾ x 6	164†*	1800	..	B-HM	E-G	....	....	56	29	47	1820
WAKB	B	S-P	4	6	6¼ x 6½	227†*	1600	..	HM	E-G	....	....	67	33	51	3150
WAKR	B	S-P	4	6	6¼ x 6½	217*	1600	..	HM	E-G	....	....	67	33	51	3050
WAKDB	A	S-P	4	6	6¼ x 6½	195†*	1600	B	....	E-G	....	....	67	33	51	3800
WAKDBS	A	S-P	4	6	6¼ x 6½	259†*	1600	B	....	E-G	T	....	67	33	63	3925
NKRB	B	S-P	4	6	7 x 8¼	260*†	1200	..	HM	G	....	....	79	48	61	6900
NKDB	A	S-P	4	6	7 x 8¼	238†*	1200	B	....	G	....	....	79	48	61	9285
NKDBS	A	S-P	4	6	7 x 8¼	312†*	1200	B	....	G	T	....	79	48	61	9435

Waukesha *(Continued from preceding page)*

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
LRORB	B	S-P	4	6	8¼ x 8½	372*	1200	..	HM	G	....	....	98	49	70	9940
LRDB	A	S-P	4	6	8½ x 8½	332†*	1200	B	....	G	....	....	98	49	70	10300
LRDBS	A	S-P	4	6	8½ x 8½	456†*	1200	B	....	G	T	....	114	49	70	10450
LRZB	B	S-P	4	6	9½ x 8½	475†*	1200	..	HM	G	....	....	114	60	73	11250
VLROB	B	S-P	4	12	8½ x 8½	720	1200	..	HM	G	....	....	130	60	58	15000
VLRDB	A	S-P	4	12	8½ x 8½	664	1200	B	....	G	....	....	130	60	58	15500
VLRDBS	A	S-P	4	12	8½ x 8½	908	1200	B	....	G	T	....	134	60	58	16300

** Continuous hp ratings are based on 80 per cent of maximum at speeds indicated. Gas ratings on natural gas & LPG are approximately 10 per cent lower.*
† Counterbalanced crankshaft.

White Motor Co.
White Diesel Engine Division
Springfield, Ohio

Superior Engines

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
6G-510	B	S-P	4	6	8½ x 9	190-370	600-1200	..	HM	A-G	....	....	....	....	....	....
40-6	A	M-S-P	4	6	8½ x 10½	215-425	600-1000	B-S	....	A	....	....	....	....	....	....
40-8	A	M-S-P	4	8	8½ x 10½	290-570	600-1000	B-S	....	A	....	....	....	....	....	....
40X-6	A	M-S-P	4	6	8½ x 10½	325-700	600-1000	B-S	....	A	T	....	....	....	....	....
40X-8	A	M-S-P	4	8	8½ x 10½	435-940	600-1000	B-S	....	A	T	....	....	....	....	....
40C-6	A	M-S-P	4	6	8½ x 10½	240-460	700-1100	B-S	....	A	....	....	....	....	....	....
40C-8	A	M-S-P	4	8	8½ x 10½	325-620	700-1100	B-S	....	A	....	....	....	....	....	....
40C-X-6	A	M-S-P	4	6	8½ x 10½	450-775	700-1100	B-S	....	A	T	....	....	....	....	....
40C-X-8	A	M-S-P	4	8	8½ x 10½	635-1025	700-1100	B-S	....	A	T	....	....	....	....	....
6G-825	B	S-P	4	6	10 x 10½	300-450	600-900	..	HM	A	....	....	....	....	....	....
8G-825	B	S-P	4	8	10 x 10½	400-600	600-900	..	HM	A	....	....	....	....	....	....
60-6	C	M-S	4	6	12 x 15	410-530	400-514	B	....	A	....	....	....	....	....	....
60-8	C	M-S	4	8	12 x 15	515-705	400-514	B	....	A	....	....	....	....	....	....
60X-6	C	M-S	4	6	12 x 15	615-950	400-514	S	....	A	T	....	....	....	....	....
60X-8	C	M-S	4	8	12 x 15	875-1250	400-514	S	....	A	T	....	....	....	....	....
66-6	C	M-S	4	6	12¾ x 15	580-720	500-600	S	....	A	....	....	....	....	....	....
66-8	C	M-S	4	8	12¾ x 15	775-960	500-600	S	....	A	....	....	....	....	....	....
66X-6	C	M-S	4	6	12¾ x 15	1105-1600	500-600	S	....	A	T	....	....	....	....	....
66X-8	C	M-S	4	8	12¾ x 15	1470-2150	500-600	S	....	A	T	....	....	....	....	....
80-6	D	M-S	4	6	14½ x 20	600-780	300-375	S	HM	A	....	....	....	....	....	....
80-8	D	M-S	4	8	14½ x 20	800-1040	300-375	S	HM	A	....	....	....	....	....	....
80X-6	C	M-S	4	6	14½ x 20	900-1400	300-375	S	....	A	T	....	....	....	....	....
80X-8	C	M-S	4	8	14½ x 20	1200-1400	300-375	S	....	A	T	....	....	....	....	....

Atlas Engines

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
35-4	A	M-S-P	4	4	6½ x 8½	100-110	900-1000	B	....	A-E	....	....	....	....	....	....
35-6	A	M-S-P	4	6	6½ x 8½	150-225	900-1250	B	....	A-E	....	....	....	....	....	....
35X-6	A	M-S-P	4	6	6½ x 8½	225-340	900-1250	B	....	A-E	T	....	....	....	....	....
45-4	A	M-S-P	4	4	9 x 10½	160-190	600-720	B-S	....	A	....	....	....	....	....	....
45-6	A	M-S-P	4	6	9 x 10½	240-300	600-750	B-S	....	A	....	....	....	....	....	....
45-8	A	M-S-P	4	8	9 x 10½	320-400	600-750	B-S	....	A	....	....	....	....	....	....
45X-6	A	M-S-P	4	6	9 x 10½	360-450	600-750	B-S	....	A	T	....	....	....	....	....
45X-8	A	M-S-P	4	8	9 x 10½	480-600	600-750	B-S	....	A	T	....	....	....	....	....
76-6	A	S	4	6	13 x 16	450-500	360-400	B	....	A	....	....	....	....	....	....
76X-6	A	S	4	6	13 x 16	675-750	360-400	B	....	A	T	....	....	....	....	....

Lorain Engines—White-Roth Machine Corporation
Lorain, Ohio

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
L	B	S	2	1	7½ x 8	27	600	..	HM	H-G	....	....	72	50	48	2810
LD	A	S	2	1	7½ x 8	23	600	S	....	G	....	....	72	50	48	2810
O	B	S	2	1	9½ x 10	42	500	..	HM	H-G	....	....	88	60	51	4300

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
OD	A	S	2	1	9½ x 10	34	500	S	....	G	....	....	88	60	51	4300
R	B	S	2	1	12 x 13	60	350	..	HM	G	....	....	112	71	66	8000
A	B	S	2	1	13 x 13	70	350	..	HM	G	....	....	112	72	66	8300
AD	A	S	2	1	13 x 13	55	350	S	....	G	....	....	112	72	66	8500

Witte Engine Works
Oil Well Supply Division, U. S. Steel Corporation
Kansas City 26, Missouri

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
AD	A	S-P	4	1	3¼ x 4½	4-5 5	1200-1500	B	....	H-E	....	....	24	24	33	450
LD	A	S-P	4	1	4¼ x 6	8	900	B	....	H-E	....	....	46	34	28	930
BD	A	S-P	4	1	4¾ x 5¼	9	1350	B	....	H-E	....	....	29	27⅞	38	842
CD	A	S-P	4	1	5 x 6	12.5	750	B	....	H-E	....	....	53	36	35	1352
B	B	S-P	4	1	5 x 6	10	900	..	HM	H	....	....	47	39	42	1285
C	B	S-P	4	1	6 x 8	15.5	750	..	HM	H	....	....	57	47	49	1760
98	B	S-P	4	1	5 x 5	10	1200	..	HM	H-E	....	....	39	36	36	655
100	A	M-S-P	4	2	4 x 4	18.0	1800	B-R	....	E	....	....	29	39	26	700

Wolverine Motor Works Div.
Coulter & McKenzie Mach. Co.
Bridgeport, Conn.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
WM426	A	M	4	6	4¼ x 5	100	1600	B	.....	A-E	.....	S	83	25	40	2800
WM426T	A	M	4	6	4¼ x 5	120	1600	B	.....	A-E	T	S	83	25	40	2600
WM779	A	M	4	6	5¼ x 6	150	1400	B	.....	A-E	.....	S	94	40	49	3100
WM779T	A	M	4	6	5¼ x 6	180	1400	B	.....	A-E	T	S	94	45	49	3400
WM1197	A	M	4	6	6¼ x 6½	210	1400	B	.....	A-E	.....	S	110	40	54	5600
WM1197T	A	M	4	6	6¼ x 6½	275	1400	B	.....	A-E	T	S	110	47	54	5900
WM1905	A	M	4	6	7 x 8¼	280	1100	B	.....	A-E	.....	S	141	41	64	10000
WM1905T	A	M	4	6	7 x 8¼	360	1100	B	.....	A-E	T	S	141	44	64	10400
WM2894	A	M	4	6	8½ x 8½	400	1100	B	.....	A-E	.....	S	171	46	84	12000
WM2894T	A	M	4	6	8½ x 8½	525	1100	B	.....	A-E	T	S	171	60	84	12500
WM2980	A	M	4	5	8½ x 10½	200	650	S	.....	A	.....	S	133	37	61	12500
WM3570	A	M	4	6	8½ x 10½	240	650	S	.....	A	.....	S	147	37	61	14400
WM3570T	A	M	4	6	8½ x 10½	360	650	S	.....	A	T	S	155	44	79	15200
WM4725	A	M	4	5	9¼ x 14	200	400	O	.....	A	.....	D	162	38	75	19200
WM5669	A	M	4	6	9¼ x 14	240	400	O	.....	A	.....	D	182	38	75	21000
WM7559	A	M	4	8	9¼ x 14	320	400	O	.....	A	.....	D	213	38	75	24750

Worthington Corporation
Harrison, New Jersey

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
W9-6	D	S-P	4	6	9 x 11	425	900	..	.....	A	.....	.....	...	...	...	.....
W9-8	D	S-P	4	8	9 x 11	570	900	..	.....	A	.....	.....	...	...	...	.....
SW9-6	D	S-P	4	6	9 x 11	955	900	..	.....	A	T	.....	...	...	...	.....
SW9-8	D	S-P	4	8	9 x 11	1275	900	..	.....	A	T	.....	...	...	...	.....
DH5	D	S-P	4	5	12 x 14	510	600	..	.....	A	.....	.....	...	...	...	.....
DH6	D	S-P	4	6	12 x 14	610	600	..	.....	A	.....	.....	...	...	...	.....
DH8	D	S-P	4	8	12 x 14	815	600	..	.....	A	.....	.....	...	...	...	.....
SDH5	D	S-P	4	5	12 x 14	830	600	..	.....	A	T	.....	...	...	...	.....
SDH6	D	S-P	4	6	12 x 14	990	600	..	.....	A	T	.....	...	...	...	.....
SDH8	D	S-P	4	8	12 x 14	1325	600	..	.....	A	T	.....	...	...	...	.....
SCC5	D	S	4	5	10¾ x 14½	515	514	..	.....	A	T	.....	...	...	...	.....
SCC6	D	S	4	6	10¾ x 14½	615	514	..	.....	A	T	.....	...	...	...	.....
SCC7	D	S	4	7	10¾ x 14½	720	514	..	.....	A	T	.....	...	...	...	.....
SCC8	D	S	4	8	10¾ x 14½	825	514	..	.....	A	T	.....	...	...	...	.....
DR5	D	S	4	5	13¼ x 17½	580	450	..	.....	A	.....	.....	...	...	...	.....
DR6	D	S	4	6	13¼ x 17½	700	450	..	.....	A	.....	.....	...	...	...	.....
DR7	D	S	4	7	13¼ x 17½	815	450	..	.....	A	.....	.....	...	...	...	.....
DR8	D	S	4	8	13¼ x 17½	930	450	..	.....	A	.....	.....	...	...	...	.....
SDR5	D	S	4	5	13¼ x 17½	1020	450	..	.....	A	T	.....	...	...	...	.....
SDR6	D	S	4	6	13¼ x 17½	1230	450	..	.....	A	T	.....	...	...	...	.....
SDR7	D	S	4	7	13¼ x 17½	1435	450	..	.....	A	T	.....	...	...	...	.....
SDR8	D	S	4	8	13¼ x 17½	1635	450	..	.....	A	T	.....	...	...	...	.....
EH5	C	S	4	5	16 x 20	730	360	..	.....	A	.....	.....	...	...	...	.....
EH6	C	S	4	6	16 x 20	880	360	..	.....	A	.....	.....	...	...	...	.....
EH7	C	S	4	7	16 x 20	1025	360	..	.....	A	.....	.....	...	...	...	.....
EH8	C	S	4	8	16 x 20	1170	360	..	.....	A	.....	.....	...	...	...	.....
SEH5	D	S	4	5	16 x 20	1285	360	..	.....	A	T	.....	...	...	...	.....
SEH6	D	S	4	6	16 x 20	1545	360	..	.....	A	T	.....	...	...	...	.....
SEH7	D	S	4	7	16 x 20	1800	360	..	.....	A	T	.....	...	...	...	.....
SEH8	D	S	4	8	16 x 20	2055	360	..	.....	A	T	.....	...	...	...	.....
SW14-6	D	S	4	6	14 x 18	1875	450	..	.....	A	T	.....	...	...	...	.....
SW14-8	D	S	4	8	14 x 18	2500	450	..	.....	A	T	.....	...	...	...	.....
SW14-12	D	S	4	12	14 x 18	3750	450	..	.....	A	T	.....	...	...	...	.....
SW14-16	D	S	4	16	14 x 18	5000	450	..	.....	A	T	.....	...	...	...	.....
BBG5	B	S-P	4	5	9 x 10½	205	600	..	.....	A	.....	.....	...	...	...	.....
BBG6	B	S-P	4	6	9 x 10½	245	600	..	.....	A	.....	.....	...	...	...	.....
CCG5	B	S-P	4	5	12¼ x 14½	445	514	..	.....	A	.....	.....	...	...	...	.....
CCG6	B	S-P	4	6	12¼ x 14½	530	514	..	.....	A	.....	.....	...	...	...	.....
CCG7	B	S-P	4	7	12¼ x 14½	620	514	..	.....	A	.....	.....	...	...	...	.....
CCG8	B	S-P	4	8	12¼ x 14½	710	514	..	.....	A	.....	.....	...	...	...	.....
DDG5	B	S	4	5	15 x 17½	560	360	..	.....	A	.....	.....	...	...	...	.....
DDG6	B	S	4	6	15 x 17½	675	360	..	.....	A	.....	.....	...	...	...	.....
DDG7	B	S	4	7	15 x 17½	785	360	..	.....	A	.....	.....	...	...	...	.....
DDG8	B	S	4	8	15 x 17½	900	360	..	.....	A	.....	.....	...	...	...	.....
EHGL5	B	S	4	5	16¾ x 20	800	360	..	.....	A	.....	.....	...	...	...	.....
EHGL6	B	S	4	6	16¾ x 20	960	360	..	.....	A	.....	.....	...	...	...	.....
EHGL7	B	S	4	7	16¾ x 20	1120	360	..	.....	A	.....	.....	...	...	...	.....
EHGL8	B	S	4	8	16¾ x 20	1280	360	..	.....	A	.....	.....	...	...	...	.....
SEHGL5	B	S	4	5	16¾ x 20	1300	360	..	.....	A	T	.....	...	...	...	.....
SEHGL6	B	S	4	6	16¾ x 20	1565	360	..	.....	A	T	.....	...	...	...	.....
SEHGL7	B	S	4	7	16¾ x 20	1825	360	..	.....	A	T	.....	...	...	...	.....
SEHGL8	B	S	4	8	16¾ x 20	2085	360	..	.....	A	T	.....	...	...	...	.....

Imported Diesels

Petter Engine Division of Brush ABOE Inc.
60-07 39th Avenue, Woodside 77, New York

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
PAZ1*	A	S-P	4	1	3 x 3	3	1800	**	....	H	....	....	18	18	26	260
AVA1*	A	M-S-P	4	1	3.15 x 4.33	6	1800	**	....	E-H	....	††	30	21	30	390
AVA2*	A	M-S-P	4	2	3.15 x 4.33	12	1800	**	....	E-H	....	††	37	21	32	558
AV1	A	M-S-P	4	1	3.15 x 4.33	6	1800	**	....	E-H	....	††	30	21	29	406
AV2	A	M-S-P	4	2	3.15 x 4.33	10-12	1500-1800	**	....	E-H	....	††	37	21	32	598
B2	A	M-S-P	4	2	4.33 x 4.33	20	1500	**	....	E-H	....	†	46	23	41	907
B3	A	M-S-P	4	3	4.33 x 4.33	30-36	1500-1800	**	....	E-H	....	†	56	23	41	1211
B4	A	M-S-P	4	4	4.33 x 4.33	40-48	1500-1800	**	....	E-H	....	†	62	23	41	1491

** Air cooled. ** Bryce. † Parsons. †† Morris. Dimensions are for "S" & "P" units.*

Bamfords——International Selling Corporation
122 E. 42nd Street, New York 17, N. Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
Z1	A	M-S	4	1	4½ x 5	3½	600	*	....	H-E	....	....	38	26	41	950
Z2	A	M-S	4	1	4½ x 5	4½-5½	600-700	*	....	H-E	....	....	38	26	41	965
Z3&4	A	M-S	4	1	5 x 6	7-8	600-700	*	....	H-E	....	....	42	39	28	1050
Z7&8	A	M-S	4	2	5 x 6	14-16	600-700	*	....	H-E	....	....	48	28	42	1470

** C.A.V.*

Burmeister & Wain American Corporation
17 Battery Place, New York 4, N.Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
20MT-30	A	S	4	2-6	7.9 x 11.8	35*	600	O	....	A	....	....	....	....	....	.....
20MTB-30	A	S	4	3-6	7.9 x 11.8	50*	600	O	....	A	T	....	....	....	....	.....
25MT-40	A	S	4	2-7	9.8 x 15.7	60*	500	O	....	A	....	....	....	....	....	.....
25MTB-40	A	S	4	3-7	9.8 x 15.7	85*	500	O	....	A	T	....	....	....	....	.....
33MT-48	A	M-S	4	3-7	13.0 x 18.9	100*	400	O	....	A	....	D	....	....	....	.....
28V-50	A	M-S	2	4-9	11.0 x 19.7	122*	360	O	....	A	....	D††	....	....	....	.....
33MTB-48	A	M-S	4	3-7	13.0 x 18.9	140*	400	O	....	A	T	D	....	....	....	.....
28VB-50	A	M-S	2	5-9	11.0 x 19.7	175*	360	O	....	A	T	D††	....	....	....	.....
35V-62 †	A	M-S	2	4-10	13.8 x 24.4	200*	300	O	....	A	....	D	....	....	....	.....
42V-75	A	M-S	2	4-10	16.5 x 29.5	240*	240	O	....	A	....	D	....	....	....	.....
35VB-62	A	M-S	2	5-10	13.8 x 24.4	270*	300	O	....	A	T	D	....	....	....	.....
42VB-75	A	M-S	2	5-10	16.5 x 29.5	324*	240	O	....	A	T	D	....	....	....	.....
50V-90	A	M-S	2	4-10	19.7 x 35.4	410*	200	O	....	A	....	D	....	....	....	.....
50VT-110	A	M-S	2	4-10	19.7 x 43.3	420*	170	O	....	A	....	D	....	....	....	.....
50VB-90	A	M-S	2	5-10	19.7 x 35.4	554*	200	O	....	A	T	D	....	....	....	.....
50VTB-110	A	M-S	2	5-10	19.7 x 43.3	567*	170	O	....	A	T	D	....	....	....	.....
74T-150	A	M-S	4	6-10	29.1 x 59.0	575*	120	O	....	A	....	D	....	....	....	.....
50VT-110/40	A	M-S	2	4-10	19.7 x 43.3/15.7	585*	170	O	....	A	....	D	....	....	....	.....
62V-115	A	M-S	2	4-10	24.4 x 45.3	600*	150	O	....	A	....	D	....	....	....	.....
62VT-115	A	M-S	2	4-10	24.4 x 45.3	600*	150	O	....	A	....	D	....	....	....	.....
62VT-140	A	M-S	2	4-12	24.4 x 55.1	655	135	O	....	A	....	D	....	....	....	.....
50VBT-110/40	A	M-S	2	5-10	19.7 x 43.3/15.7	790*	170	O	....	A	T	D	....	....	....	.....
62VB-115	A	M-S	2	5-10	24.4 x 45.3	810*	150	O	....	A	T	D	....	....	....	.....
62VTB-115	A	M-S	2	5-10	24.4 x 45.3	810*	150	O	....	A	T	D	....	....	....	.....
74VT-140	A	M-S	2	4-10	29.1 x 55.1	875*	125	O	....	A	....	D	....	....	....	.....
62VTB-140	A	M-S	2	5-12	24.4 x 55.1	900	135	O	....	A	T	D	....	....	....	.....
74VT-160	A	M-S	2	5-12	29.1 x 63.0	920*	115	O	....	A	....	D	....	....	....	.....
74VTB-140	A	M-S	2	5-12	29.1 x 55.1	1190*	125	O	....	A	T	D	....	....	....	.....
75VT-150/50	A	M-S	2	4-10	29.5 x 59.0/19.7	1230*	120	O	....	A	....	D	....	....	....	.....
74VTB-160	A	M-S	2	5-12	29.1 x 63.0	1250*	115	O	....	A	T	D	....	....	....	.....
75VT-170/60	A	M-S	2	4-10	29.5 x 66.9/23.6	1300*	110	O	....	A	....	D	....	....	....	.....
75VTB-150/50	A	M-S	2	4-10	29.5 x 59.0/19.7	1650*	120	O	....	A	T	D	....	....	....	.....
75VTB-170/60	A	M-S	2	4-10	29.5 x 66.9/23.6	1755*	110	O	....	A	T	D	....	....	....	.....
ALPHA-340	A	M	2	2-4	7.9 x 13.4	45*	450	O	....	A	....	††	....	....	....	.....
ALPHA-400	A	M	2	2-6	9.1 x 15.7	60*	375	O	....	A	....	††	....	....	....	.....
ALPHA-490	A	M	2	4-8	11½ x 19¼	120	310	O	....	A	....	††	....	....	....	.....
BUKH-EV80	A	M-S-P	4	1	3.1 x 4.3	6*	1800	B	....	E-H**	....	....	....	....	....	.....
BUKH-EV100	A	M-S-P	4	1-3	3.9 x 5.1	10*	1500	B	....	E-H**	....	††	....	....	....	.....

** Hp per cylinder. ** Also cartridge start. †† Controllable pitch propeller and sailing clutch of own manufacture. On models with dual stroke, shorter stroke is for exhaust piston.*

Crofton Industrial Diesel Engines
San Diego 1, California

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
6-1A	A	....	4	1	3 1/16 x 3 1/16	4	1500	B	....	H-E	....	....	28*	19	28	235
4-1W	A	M-S	4	1	3 1/16 x 3 1/16	5-7	1500	B	....	H-E	....	....	39	18	27	246
5-1W	A	M-S	4	1	3 1/16 x 3 1/16	7-9	1500	B	....	H-E	....	....	39	18	27	266
7-1W	A	M-S	4	1	3 1/16 x 3 1/16	9-11	1500	B	....	H-E	....	....	39	18	27	275

** Includes starting handle. Ricardo type precombustion system is used. 1955 Listings used. No new listings available.*

Henschel & Sohn GmbH
Kassel, Germany

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
515DE	A	M-S-P	4	2	3.51 x 4.92	18–21	1800	†	....	E	....	....	25	29	32	505
519D2	A	M-S-P	4	2	4.12 x 5.12	23–27	1800	†	....	E	....	....	28	22	35	605
516DF	A	M-S-P	4	4	3.51 x 4.92	41–48	2000	†	....	E	....	....	35	32	33	770
517D4	A	M-S-P	4	4	3.93 x 5.12	67–84	2200–2500	†	....	E	....	....	34	27	35	725
512DG	A	M-S-P	4	6	3.78 x 4.92	79–101	2000–2200	†	....	E	....	....	45	24	43	925
512DJ	A	M-S-P	4	6	3.78 x 4.92	79–106	2000–2400	†	....	E	....	....	49	26	41	990
522DP	A	M-S-P	4	6	3.93 x 5.12	101–127	2200–2500	†	....	E	....	....	44	26	42	1025
522DPU*	A	P	4	6	3.93 x 5.12	127	2500	†	....	E	....	....	50	50	18	1100
513DC	A	M-S-P	4	6	4.32 x 5.90	120–148	2000–2200	†	....	E	....	....	53	33	44	1330
514DCU*	A	P	4	6	4.53 x 5.90	170	2200	†	....	E	....	....	52	48	22	1430
520DO	A	M-S-P	4	6	4.92 x 5.90	151–185	1800–2000	†	....	E	....	....	53	36	47	1480
521DS	A	M-S-P	4	6	5.31 x 6.1	150–175	1600–1800	†	....	E	....	....	64	31	50	2200
521DU*	A	M-S-P	4	6	5.31 x 6.1	150–175	1600–1800	†	....	E	....	....	70	56	22	2250
521DS-L	A	M-S-P	4	6	5.31 x –.1	200–250	1600–1800	†	....	E	T	....	67	31	50	2400
521DU-L*	A	M-S-P	4	6	5.31 x –.1	200–250	1600–1800	†	....	E	T	....	73	56	24	2450
583D8V	A	M-S-P	4	8	5.31 x 6.1	200–230	1600–1800	†	....	E	....	....	51	39	48	2800
583D8V-L	A	M-S-P	4	8	5.31 x 6.1	260–330	1600–1800	†	....	E	T	....	51	39	51	3100
580D12V	A	M-S-P	4	12	5.31 x 6.1	300–350	1600–1800	†	....	A-E	....	....	70	39	48	3200
580D12V-L	A	M-S-P	4	12	5.31 x 6.1	400–500	1600–1800	†	....	A-E	T	....	73	39	51	3750

** Horizontal Engine, † Robert Bosch Equipment. For first 11 engines, low end of hp & rpm range is for "S" and "M" applications—High end is for "P". For remaining engines, high end is for railcar, low end for "M", "S" and "P". 1955 Listings. 1956 Data not available.*

Klockner-Humboldt-Deutz———Diesel Energy Corporation
82 Beaver Street New York 6, N. Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
MAH711	A	M-S-P	4	1	3½ x 4⅛	6	1500	O	....	H	....	....	31	24	21	374
MAH914	A	M-S-P	4	1	4 x 5½	11	1500	O	....	H	....	....	39	30	26	693
MAH916	A	S-P	4	1	4¼ x 6⅝	16	1300	O	....	H-A	....	....	44	35	28	957
MAH320	A	S-P	4	1	6¼ x 7½	26	1000	O	....	H-A	....	....	55	39	32	1694
F2M417	A	S-P	4	2	4¼ x 6⅝	32	1800	O	....	H-E	....	....	35	29	44	1441
F1&2L612	A*	M-S-P	4	1 & 2	3½ x 4¼	10 & 20	2000	O	....	H-E	....	....	24&31	21	31	506**
F4L612	A*	M-S-P	4	4	3½ x 4¼	40	2000	†	....	E	....	....	35	25	33	594
A1-6L514	A*	M-S-P	4	1-4 & 6	4⅜ x 5½	16–100	1800	†	....	H-E	....	....	63	33	40	1606**
A6L614	A*	S-P	4	V-6	4⅜ x 5½	100	1800	†	....	E	....	....	39	46	25	1672
A8L614	A*	M-S-P	4	V-8	4⅜ x 5½	130	1800	†	....	E	....	....	43	43	36	1936
A12L614	A*	M-S-P	4	V-12	4⅜ x 5½	200	1800	†	....	E	....	....	67	48	35	2794
F1L514	A*	P	4	1	4⅜ x 5½	16	1800	O	....	H-E	....	....	22	24	41	723
A2-6L514	A*	P	4	2-4 & 6	4⅜ x 5½	32–125	1800–2300	O†	....	H-E	....	....	63	33	40	1430**
F6L614	A*	P	4	V-6	4⅜ x 5½	125	2300	†	....	E	....	....	39	46	25	1595
F8L614	A*	P	4	V-8	4⅜ x 5½	170	2300	†	....	E	....	....	43	43	36	1870
F12L614	A*	P	4	V-12	4⅜ x 5½	250	2300	†	....	E	....	....	67	48	44	2750
A4-8M517	A	M-S-P	4	4, 6 & 8	5⅛ x 6¾	83–170	1500	†	....	A-E	....	....	84	30	48	2992**
BA8M517	A	M-S-P	4	8	5⅛ x 6¾	250	1500	†	....	E-A	T	....	84	30	51	3300
F6M617	A	P	4	6	5⅛ x 6¾	175	1800	†	....	E	....	....	63	30	48	2420
T4M320	A	M-S-P	2	V-4	6⅞ x 7⅞	133	800	O	....	A-E	....	....	59	52	51	3110
T8M320	A	M-S-P	2	V-8	6⅞ x 7⅞	267	800	O	....	A-E	....	....	80	48	61	4895
T12M320	A	M-S-P	2	V-12	6⅞ x 7⅞	400	800	O	....	A-E	....	....	98	63	63	7040
T4M420	A	M-S-P	2	V-4	6⅞ x 7⅞	167	1000	O	....	E	....	....	59	52	51	3245
T8M420	A	M-S-P	2	V-8	6⅞ x 7⅞	333	1000	O	....	E	....	....	80	48	61	4730
T12M420	A	M-S-P	2	V-12	6⅞ x 7⅞	500	1000	O	....	E	....	....	98	52	63	6600
T2-4M425	A	M-S-P	2	2-4	5⅞ x 9⅛	47–95	600	O	....	A	....	....	71	37	56	6380**
T4M525	A	M-S-P	2	V-4	6⅞ x 9⅛	216	650	O	....	A	....	D	64	59	77	6710
T8M525	A	M-S-P	2	V-8	6⅞ x 9⅛	433	650	O	....	A	....	D	69	59	77	9790
T12M525	A	M-S-P	2	V-12	6⅞ x 9⅛	650	650	O	....	A	....	D	117	59	77	12540
T4M625	A	M-S-P	2	V-4	6⅞ x 9⅛	250	750	O	....	A	....	D	64	59	77	6710
T8M625	A	M-S-P	2	V-8	6⅞ x 9⅛	500	750	O	....	A	....	D	69	59	77	9790
T12M625	A	M-S-P	2	V-12	6⅞ x 9⅛	750	750	O	....	A	....	D	117	59	77	12540
T4M233	A	M-S-P	2	4	8⅝ x 13	250	500	†	....	A	....	D	93	58	73	10120
T8M233	A	M-S-P	2	V-8	8⅝ x 13	500	500	†	....	A	....	D	110	97	71	14520
A4-8M428	A	M-S-P	4	4, 6 & 8	8⅝ x 11	150–310	600	O	....	A	....	D	116	36	65	10120**
V6M486	A	M-S-P	4	6	9½ x 14¼	300	500	O	....	A	....	D	134	42	77	21230
V6&8M536	A	M-S-P	4	6 & 8	10⅝ x 14¼	375 & 500	500	O	....	A	....	D	164	42	83	27500**
V6&8M545	A	M-S	4	6 & 8	12⅝ x 17¾	500 & 660	375	O	....	A	....	D	161	53	95	41500**
BV6&8M536	A	M-S-P	4	6 & 8	10⅝ x 14¼	560 & 750	500	O	....	A	T	D	140	42	94	27940**
BV6&8M545	A	M-S	4	6 & 8	12⅝ x 17¾	800 & 1060	375	O	....	A	T	D	201	53	129	43230**
V6&8M366	A	M-S	4	6 & 8	16½ x 26	915 & 1210	275	O	....	A	....	D	295	72	142	117920**
BV6&8M366	A	M-S	4	6 & 8	16½ x 26	1500 & 2000	275	O	....	A	T	D	300	72	178	119460**

** Air cooled. † Denotes Robert Bosch Equipment. ** Where range of engines is shown, weights and dimensions are for largest engine in range. In most cases, width and height are the same for all engines in the range.*

Lister-Blackstone, Inc.
420 Lexington Avenue, New York 17, N. Y.

Lister Engines

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
3½-1	A	S-P	4	1	3⅝ x 5½	3½	650	B	....	H	....	....	36	24	40	750
6-1	A	S-P	4	1	4½ x 5½	6	650	B	....	H	....	....	36	24	40	760
12-2	A	S-P	4	2	4½ x 5½	12	650	B	....	H	....	....	50	24	40	1130
21-2	A	M-S	4	2	4½ x 5½	21	1200	B	....	H-E-A	....	....	48	25	41	1625
30-3	A	M-S	4	3	4½ x 5½	30	1200	B	....	H-E-A	....	....	58	25	41	2040
40-4	A	M-S	4	4	4½ x 6½	40	1200	B	....	H-E-A	....	....	67	25	41	2275
61-6	A	M-S	4	6	4½ x 5½	63	1200	B	....	A-E†	....	....	75	33	44	3000
FR1	A	M-S-P	4	1	3¾ x 4½	9	1800	B	....	H-E	....	S	27	23	36	750
FR2	A	M-S-P	4	2	3¾ x 4½	18	1800	B	....	H-E	....	S	32	23	36	970
FR3	A	M-S-P	4	3	3¾ x 4½	27	1800	B	....	H-E	....	S	37	23	36	1100
FR4	A	M-S-P	4	4	3¾ x 4½	36	1800	B	....	H-E	....	S	44	23	36	1270
FR6	A	M-S-P	4	6	3¾ x 4½	54	1800	B	....	H-E	....	S	54	23	36	1590

Maschinenbau Kiel Aktiengesellschaft
MaK, Kiel, Germany

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
MZ582	A	M-S	4	10	15 5/8 x 22 3/4	1250	300	*	....	A	....	D	335	56	137	122000
MA582	A	M-S	4	8	15 5/8 x 22 3/4	1000	300	*	....	A	....	D	280	56	137	95000
MS582	A	M-S	4	6	15 5/8 x 22 3/4	750	300	*	....	A	....	D	226	56	137	80000
MZ582A	A	M-S	4	10	15 5/8 x 22 3/4	1920	300	*	....	A	T	D	335	56	137	126000
MN582A	A	M-S	4	9	15 5/8 x 22 3/4	1720	300	*	....	A	T	D	305	56	137	115000
MA582A	A	M-S	4	8	15 5/8 x 22 3/4	1530	300	*	....	A	T	D	280	56	137	102000
MS582A	A	M-S	4	6	15 5/8 x 22 3/4	1150	300	*	....	A	T	D	226	56	137	82000
4Z42	A	M-S	2	4	11 7/8 x 16 1/2	500-600	370-428	*	....	A	....	D	138	75	105	26500
6Z42	A	M-S	2	6	11 7/8 x 16 1/2	750-900	370-428	*	....	A	....	D	175	75	105	36000
8Z42	A	M-S	2	8	11 7/8 x 16 1/2	1000-1200	370-428	*	....	A	....	D	210	75	105	46000
MV423	A	M-S	4	4	11 7/8 x 16 1/2	240-265	340-375	*	....	A	....	D	120	48	93	21000
MS423	A	M-S	4	6	11 7/8 x 16 1/2	390-450	370-428	*	....	A	....	*	155	48	93	30000
MA423	A	M-S	4	8	11 7/8 x 16 1/2	520-600	375-428	*	....	A	....	D	189	48	93	37000
MS423A	A	M-S	4	6	11 7/8 x 16 1/2	560-690	370-428	*	....	A	T	D	155	48	93	31000
MA423A	A	M-S	4	8	11 7/8 x 16 1/2	760-920	375-428	*	....	A	T	D	189	48	93	40000
MD36	A	M-S	4	3	8 1/2 x 14 1/2	90-120	375-500	*	....	A	....	D	84	44	79	9900
MV36	A	M-S	4	4	8 1/2 x 14 1/2	120-160	375-500	*	....	A	....	*	98	44	79	11900
MS36	A	M-S	4	6	8 1/2 x 14 1/2	180-240	375-500	*	....	A	....	D	125	44	79	16400
MS36A	A	M-S	4	6	8 1/2 x 14 1/2	270-360	375-500	*	....	A	T	D	125	44	80	17200
MS301	A	M-S-P	4	6	9 1/2 x 11 13/16	400	750	*	....	A	....	*	115	35	75	13900
MA301	A	M-S-P	4	8	9 1/2 x 11 13/16	525	750	*	....	A	....	*	140	35	75	17200
MS301A	A	M-S-P	4	6	9 1/2 x 11 13/16	575	750	*	....	A	T	*	118	35	75	14600
MS301C	A	M-S-P	4	6	9 1/2 x 11 13/16	650	750	*	....	A	T	*	134	35	75	14600
MS301CK	A	M-S-P	4	6	9 1/2 x 11 13/16	750	750	*	....	A	T	*	137	35	75	14900
MA301A	A	M-S-P	4	8	9 1/2 x 11 13/16	800	750	*	....	A	T	*	162	35	78	17900
MA301C	A	M-S-P	4	8	9 1/2 x 11 13/16	900	750	*	....	A	T	*	171	35	79	17900
MA301CK	A	M-S-P	4	8	9 1/2 x 11 13/16	1000	750	*	....	A	T	*	167	35	79	18100
MV24	A	M-S-P	4	4	7 1/2 x 9 1/2	80-160	500-1000	*	....	A-E	....	*	68	33	57	6200
MS24	A	M-S-P	4	6	7 1/2 x 9 1/2	120-240	500-1000	*	....	A-E	....	*	68	33	57	8400

* *Make not known.*

Maschinenfabrik-Augsburg-Nuernberg A. G.
American M-A-N Corp., 149 Broadway, New York 6, N. Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
D9614	A†††	M-S-P	4	4	3.78 x 4.33	40	2000	†	....	E	....	....	32	24	33	1000
D1246	A†††	M-S-P	4	6	4.41 x 5.51	100	2000	†	....	E	....	....	47	25	40	1410
D1548	A†††	M-S-P	4	8	4.53 x 5.51	135	2000	†	....	E	....	....	44	43	49	1820
D1548mA	A†††	M-S-P	4	8	4.53 x 5.51	170	2000	†	....	E	T	....	44	43	49	1895
WV14/18	D	M-S-P	4	4 & 6	5.51 x 7.08	95 & 180	1200&1500	†	....	A-E	....	....	45&62	25	46	.....
WV14/18mA	A	M-S-P	4	6	5.51 x 7.08	275	1500	†	....	A-E	T	....	73	25	50	4300
WV17.5/22A	D	M-S-P	4	3-8	6.89 x 8.66	100-320	900-1200	†	....	A-E	....	....	44-98	32	53-57	.....
WV17.5/22AmA	A	M-S-P	4	6 & 8	6.89 x 8.66	310-460	1000-1200	†	....	A	T	....	93&115	32	55&63	.....
WV22/30A	A	M-S-P	4	6 & 8	8.66 x 11.81	330-520	750-900	†	....	A	....	....	98&122	30	74	.....
WV22/30AmA	A	M-S-P	4	6 & 8	8.66 x 11.81	610-950	750-900	†	....	A	T	....	98&122	30	75&78	.....
VV22/30	A	M-S-P	4	12 & 16	8.66 x 11.81	660-1040	750-900	†	....	A	....	....	...	...	...	.....
VV22/30mA	A	M-S-P	4	12 & 16	8.66 x 11.81	1220-1900	750-900	†	....	A	T	....	...	...	...	.....
WV30/38A	A	M-S	4	6,8,10&12	12.99 x 14.96	620-1440	600-700	†	....	A	....	D	...	...	...	.....
WV30/38AmA	A	M-S	4	6,8,10&12	12.99 x 14.96	985-2300	600-700	†	....	A	T	D	...	...	...	.....
LV17.5/21B	A	M-S-P	4	12	6.89 x 8.27	500-700	1400-1500	†	....	A-E	....	....	78	28	59	6590
LV17.5/21BmA	A	M-S-P	4	12	6.89 x 8.27	720-1000	1400-1500	†	....	A-E	T	....	78	28	76	7470
GV23.5/33	D	M-S	4	3-8	9.25 x 12.99	145-440	514-600	O	....	A	....	D	...	...	...	.....
GV23.5/33mA	D	M-S	4	6-8	9.25 x 12.99	515-685	600	O	....	A	T	D	...	...	...	.....
GV30/45	D	M-S	4	3-9	11.81 x 17.71	160-790	250-428	O	....	A	....	D	...	...	...	.....
GV30/45MA	D	M-S	4	6-9	11.81 x 17.71	475-1170	250-428	O	....	A	T	D	...	...	...	.....
GV40/60	D	M-S	4	5-10	15.75 x 23.62	655-1430	273-300	O	....	A	....	D	...	...	...	.....
GV40/60mA	D	M-S	4	5-10	15.75 x 23.62	1050-2280	273-300	O	....	A	T	D	...	...	...	.....
GV52/74A	D	M-S	4	6-10	20.47 x 29.13	1500-2500	250	O	....	A	....	D	...	...	...	.....
GV52/74AmA	D	M-S	4	6-10	20.47 x 29.13	2400-4000	250	O	....	A	T	D	...	...	...	.....
KV45/66mHA	A††	M-S	4	6-8	17.71 x 25.98	2800-3730	250	O	....	A	T*	D	...	...	...	.....
GZ52/70	A	M-S	2	5-10	20.47 x 27.56	1920-4250	225-250	O	....	A	....	D	...	...	...	.....
GZ52/90	A	M-S	2	5-10	20.47 x 35.43	1650-4100	150-187	O	....	A	....	D	...	...	...	.....
KZ57/80	A††	M-S	2	5-10	22.44 x 31.50	2350-5300	200-225	O	....	A	....	D	...	...	...	.....
KZ57/80mA	A††	M-S	2	6-10	22.44 x 31.50	3990-6650	225	O	....	A	T	D	...	...	...	.....
KZ60/105	A††	M-S	2	5-10	23.62 x 41.34	2840-5670	167	O	....	A	....	D	...	...	...	.....
KZ60/105mA	A††	M-S	2	6-10	23.62 x 41.34	4240-7070	167	O	....	A	T	D	...	...	...	.....
KZ70/120	A††	M-S	2	4-10	27.56 x 47.24	2460-6950	115-130	O	....	A	....	D	...	...	...	.....
KZ70/120mA	A††	M-S	2	6-10	27.56 x 47.24	5250-8700	130	O	....	A	T	D	...	...	...	.....
KZ78/140	A††	M-S	2	6-10	30.70 x 55.10	5400-9000	115	O	....	A	....	D	...	...	...	.....
KZ78/140mA	A††	M-S	2	6-10	30.70 x 55.10	6750-11250	115	O	....	A	T	D	...	...	...	.....
DZ53/80	A**	M-S	2	4-10	20.87 x 31.50	3240-8100	214	O	....	A	....	D	...	...	...	.....
DZ60/110	A**	M-S	2	5-10	23.62 x 43.31	4280-8550	130	O	....	A	....	D	...	...	...	.....
DZ72/120	A**	M-S	2	5-10	28.34 x 47.24	6220-12450	120	O	....	A	....	D	...	...	...	.....

* *Highly supercharged.* ** *Double acting.* † *Denotes Robert Bosch Equipment.* †† *Crosshead* ††† *"Whisper" Engine (With MAN Patented Silent Combustion Principle)*

Sulzer Bros. Ltd., New York
50 Church Street, New York 7, N.Y.

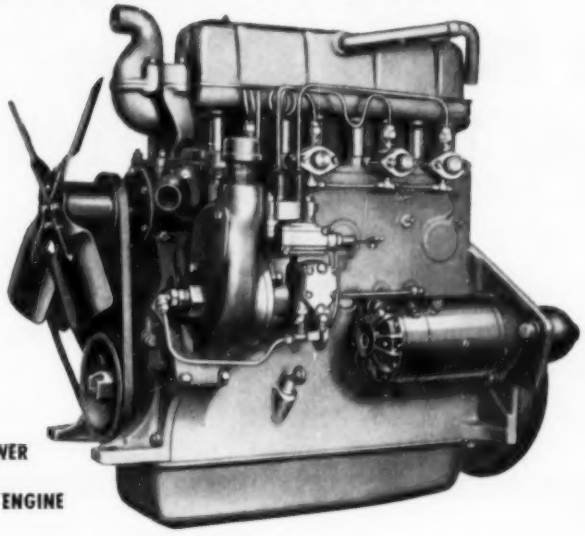
Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
BA22	C	S	4	3-8	8.67 x 12.6	200-600	500-600	O	....	A	T	....	...	...	...	.....
BA29	C	S	4	6-8	11.4 x 14.4	700-950	500	O	....	A	T	....	...	...	...	.....
BA36	A	S	4	8	14.4 x 23.6	2000	425	O	....	A	T	....	...	...	...	.....
T24	A	M	2	4&6	9.46 x 15.75	300&450	400	O	....	A	....	O-D	...	...	...	.....
T29	A	M	2	4-9	11.4 x 19.75	400-900	300	O	....	A	....	D	...	...	...	.....
T36	A	M-S	2	4-10*	14.4 x 23.6	600-1600	250-300	O	....	A	....	D	...	...	...	.....
T48	C	M-S	2	4-12†	18.9 x 27.5	1400-4200	225-250	O	....	A	....	D	...	...	...	.....
T66	A	M	2	5-8	22.1 x 39.4	2000-3200	155	O	....	A	....	D	...	...	...	.....
SD60	A	M	2	5-10	23.6 x 41	2500-5000	150	O	....	A	....	D	...	...	...	.....
SD72	A	M	2	5-12	28.3 x 49.3	3500-8400	125	O	....	A	....	D	...	...	...	.....
SF72	C	S	2	6-12	28.3 x 55.4	4500-9000	187	O	....	A	....	....	...	...	...	.....
LDA19	A	P	4	6	7.5 x	420	1100	O	....	E	T	....	...	...	...	.....
LDA22	A	P	4	6	8.67 x	570	950	O	....	E	T	....	...	...	...	.....
LDA25	A	P	4	6 & 8	9.85 x	735 & 960	850	O	....	E	T	....	...	...	...	.....
LDA28	A	P	4	6, 8 & 12	11.0 x	920-2000	750 & 938	O	....	E	T	....	...	...	...	.....
LDA31	A	P	4	12	12.3 x	2250	935	O	....	E	T	....	...	...	...	.....
RSD58	A	M	2	4-12	22.8 x 29.9	2080-6240	240	O	....	A	T	D	...	...	...	.....
RSD76	A	M	2	4-12	29.9 x 61	4000-15000	115	O	....	A	T	D	...	...	...	.....

* *4 to 8 for stationary.* † *5 to 12 for marine.*

CONTINENTAL

*CUSHIONED POWER DIESELS

34 to 225 HORSEPOWER



MODEL ED208
CUSHIONED POWER
DIESEL
AGRICULTURAL ENGINE

There are three main reasons why Continental's Cushioned Power principle results in higher performance and more efficient operation.

1. Combustion chamber design assures higher turbulence, promotes cleaner burning. All fuel is utilized.

•

2. Operation is smoother. Cushioning of the explosive force results in reduction of noise.

•

3. Easing of peak forces on rods, shafts, and bearings makes for longer service, with less time out for repairs. By permitting wide interchangeability of parts with Red Seal* gasoline models, it greatly simplifies the job of service in the field.

Continental Cushioned Power Diesels are now available for various applications in transportation, agriculture and industry. Write for bulletins and color folder showing how Cushioned Power works.

PARTS AND SERVICE COAST TO COAST

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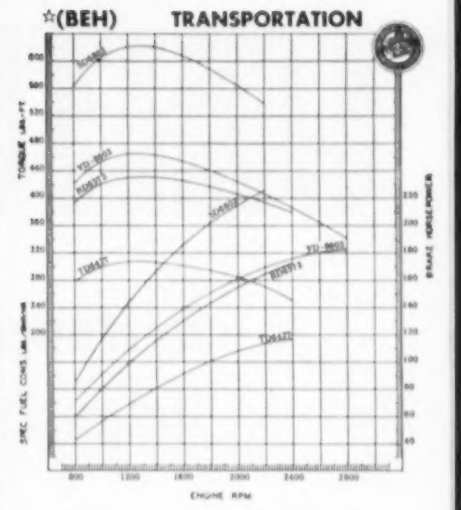

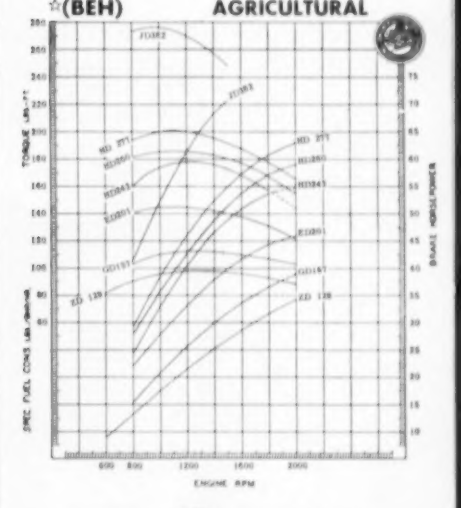

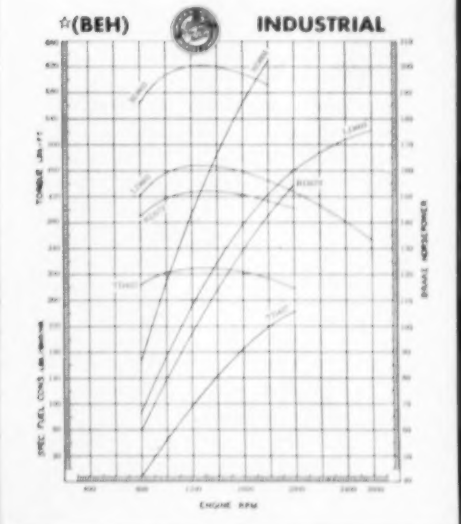

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FOR INDUSTRIAL APPLICATIONS ONLY.

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Continental Motors Corporation
MUSKEGON, MICHIGAN

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3817 SOUTH SANTA FE AVENUE, LOS ANGELES 58, CALIFORNIA • 1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GEORGIA

UNITED

Rectangular Diesel Air Cleaner Helps Crawler Tractors Breathe Easily

This new United Specialties rectangular diesel oil bath air cleaner provides major improvements in air cleaner design and operation. It is available for truck and tractor engines, and for industrial power units.

1. Meets Limited Space Requirements

Rectangular shape of air cleaner conforms better to engine shape — fits snugly under hood — makes most efficient use of available space.

2. Lower Installation Cost

Air cleaner outlet can be taken at any point around the perimeter of the clean air chamber, providing the shortest connection to manifold.

3. More Air Volume

The rectangular cleaner, with sides of the same length as the diameter of a circular cleaner, contains far more surface area. This helps slow down air velocity through cleaner, safeguards against oil carryover from cleaner to engine.

4. Simple Maintenance

Removable scrubber element can be easily detached for cleaning.

For the newest and finest in oil bath air cleaner protection, call on United Specialties. Our experienced sales engineers can help you with your air cleaner design problems. We invite your inquiry.

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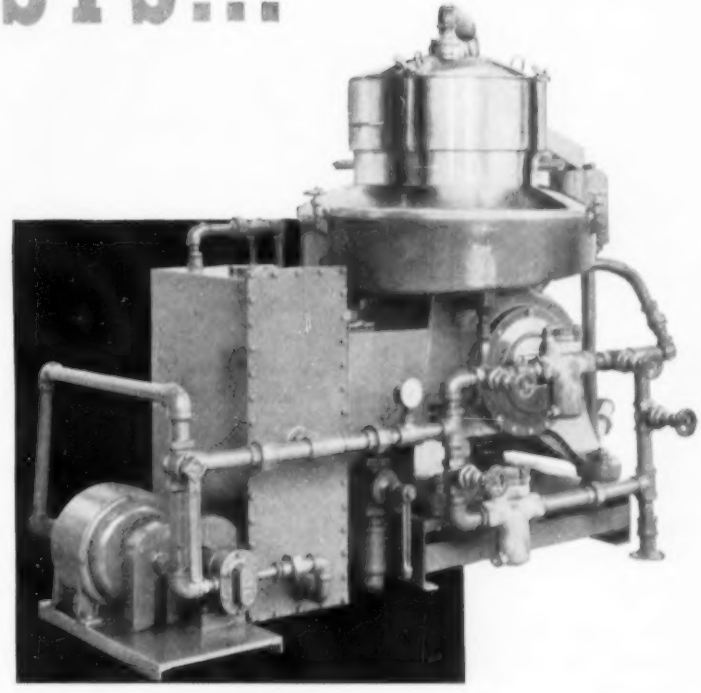
Air Cleaners · Metal Stampings · Rolled Shapes · Ignition Switches · Turn Signal Switches · Dovetails

DOWN COME DIESEL FUEL COSTS...



• • • when the Sharples Residual Oil Purifier goes to work for you.

In addition to making Bunker "C" available as a low cost fuel, this continuous unit eliminates the headaches of frequent bowl cleanings.

Sharples has a record of fuel savings that spans 30 years. We'll gladly give you the eye-opening facts.

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THE SHARPLES CORPORATION
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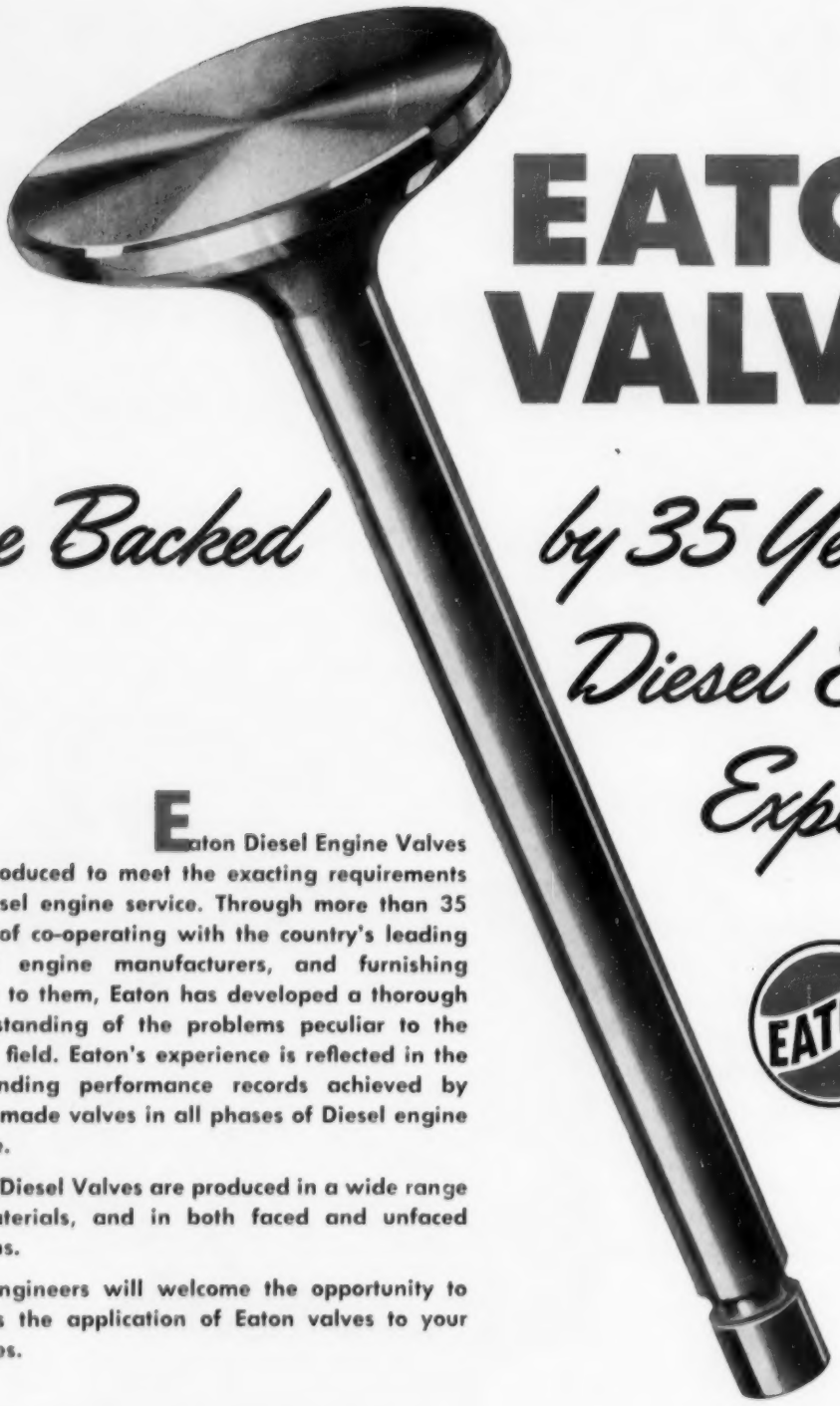


EATON VALVES

are Backed by 35 Years of Diesel Engine Experience

Eaton Diesel Engine Valves are produced to meet the exacting requirements of Diesel engine service. Through more than 35 years of co-operating with the country's leading Diesel engine manufacturers, and furnishing valves to them, Eaton has developed a thorough understanding of the problems peculiar to the Diesel field. Eaton's experience is reflected in the outstanding performance records achieved by Eaton-made valves in all phases of Diesel engine service.

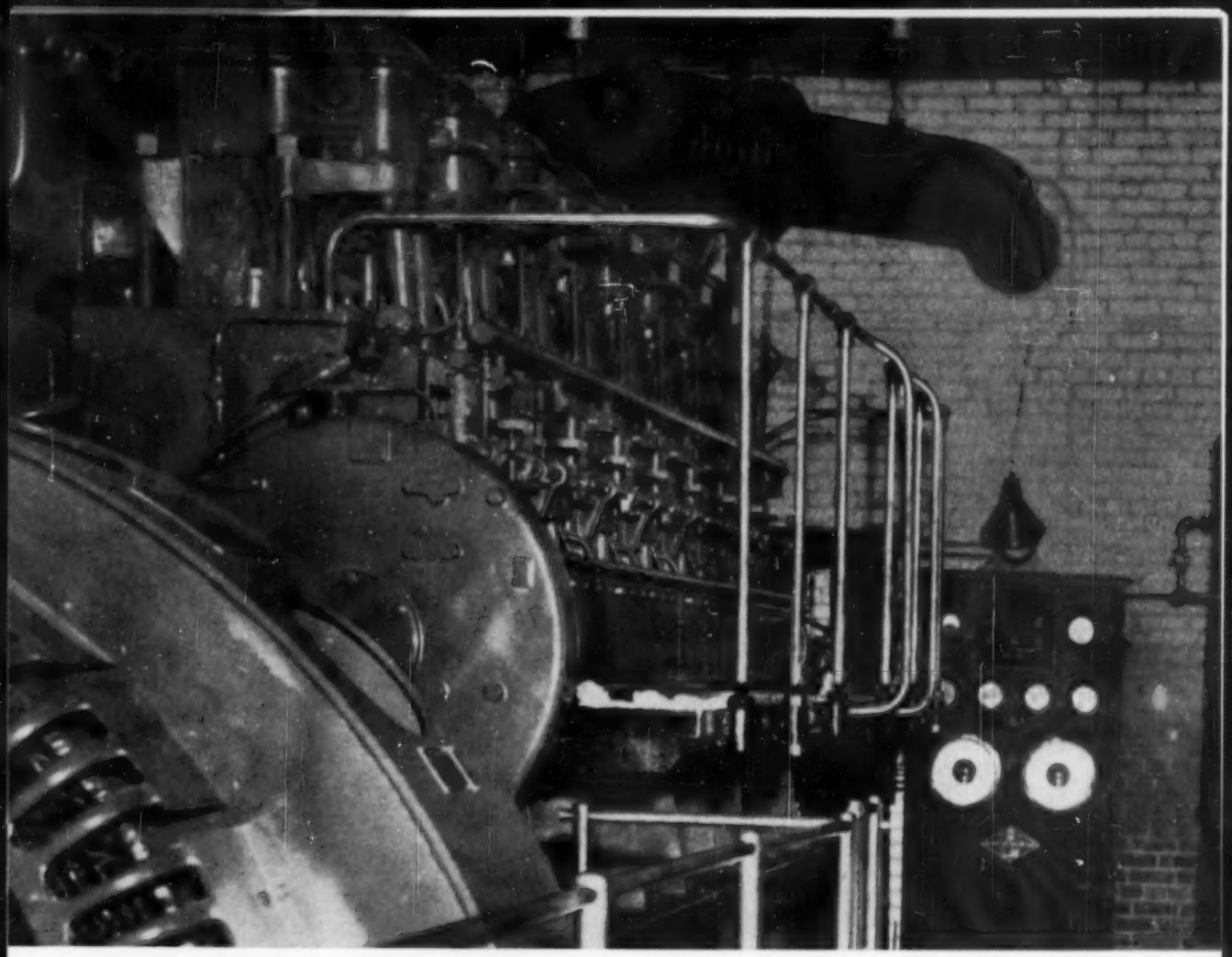
Eaton Diesel Valves are produced in a wide range of materials, and in both faced and unfaced designs.

Our engineers will welcome the opportunity to discuss the application of Eaton valves to your engines.

EATON

VALVE DIVISION
MANUFACTURING COMPANY
9771 FRENCH ROAD • DETROIT 13, MICHIGAN

PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers



Cut power costs up to 60% with BALDWIN or HAMILTON Diesel or dual fuel engines

You can cut *your* power generating costs by as much as 60%. Baldwin and Hamilton Diesel and dual fuel engines are doing just that for users in all parts of the country.

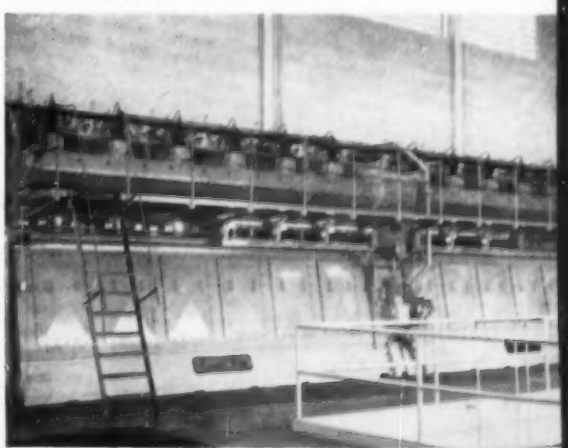
BALDWIN 600 Series 12¾ x 15½ turbocharged Diesels have 6 or 8 cylinders. They develop 450 to 1500 hp at 400 to 625 rpm.

HAMILTON 21½ x 27½ Diesel and dual fuel engines are available with 5 to 12 cylinders. Their net horsepower ranges from 2350 to 5450.

Get the full story today. Let us show you how to cut *your* power generating costs with these dependable, economical power sources. Write for new bulletin . . . Dept. 9570, Hamilton Division, BLH Corporation, Hamilton, Ohio.

QUAKERTOWN, PA., saved three ways with a 1560 hp Baldwin . . . (1) Initial cost was much less than boiler and turbine. (2) The medium speed Baldwin (600 rpm) saved fuel and lube oil. Total operating costs—including amortization . . . 60% under purchased power. (3) Baldwin standby service has cut weekend operating costs 25%.

DECATUR, IND., uses a 3810 kw Hamilton 21½ x 27½ heavy fuel engine. Operating 18 to 20 hours a day, it burns heaviest residual fuels with an absolutely invisible exhaust . . . with no unusual piston ring or liner wear. Decatur's fuel cost is just 4.6 mills per kwh.



BALDWIN BLH LIMA-HAMILTON

HAMILTON DIVISION

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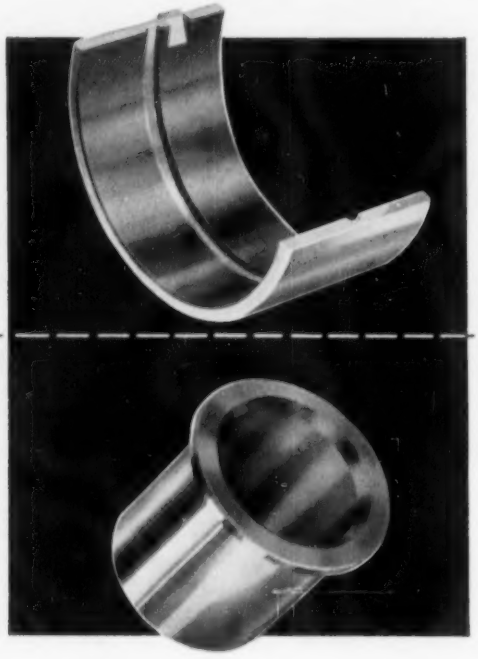
DIVISIONS: Austin-Western • Eddystone • Hamilton • Electronics & Instrumentation • Lima • Madsen • Loewy-Hydropress • Pelton • Standard Steel Works

The standard for the leaders in new engine design

Detroit Aluminum and Brass

COPPER LEAD*

engine bearings



Detroit Aluminum & Brass is your dependable source for high duty, aircraft quality, copper lead bearings and sintered copper lead bearings. They are produced with the same high degree of accuracy and precision as the engine bearings of all types we have been supplying to the leaders in the industry since 1925.

*Copper lead bearings are lead-tin overplated to customer's specifications.

Tell our engineers about your requirements. Write...

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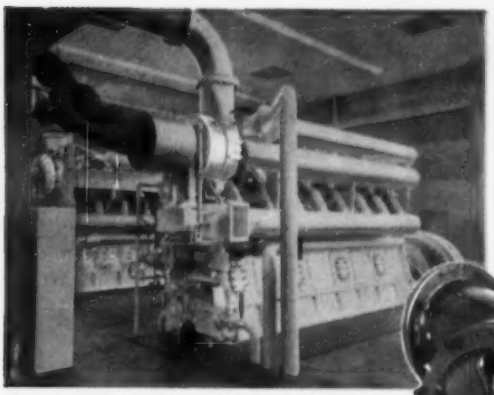
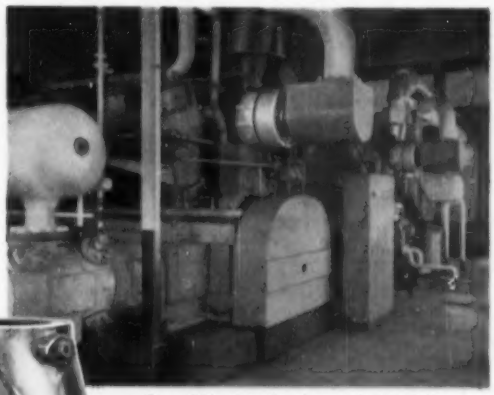
***Plants at* Detroit, Michigan and Bellefontaine, Ohio**

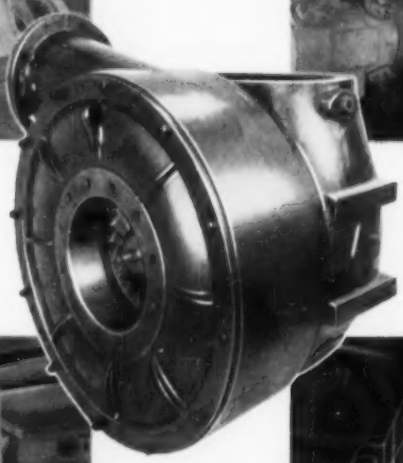
You can count on ELLIOTT turbocharging!



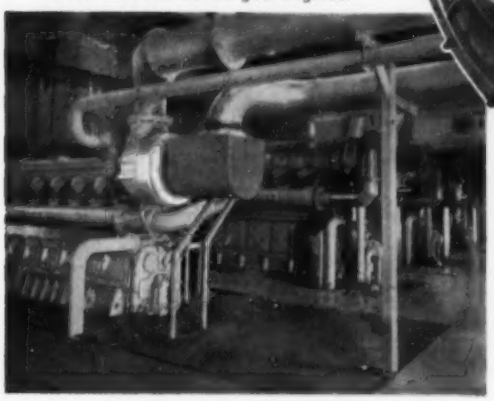
The Elliott turbocharged engine in the foreground is a recent addition in this municipal plant. Earlier Elliott model in background.



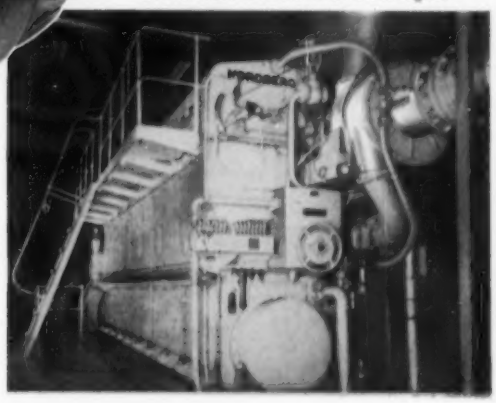
Two Elliott turbocharged 1350-hp engines on the job in a natural gas company pipe line station in the Southwest.



Elliott turbocharger in modern municipal plant. In the rear are three other Elliott turbocharged engines.



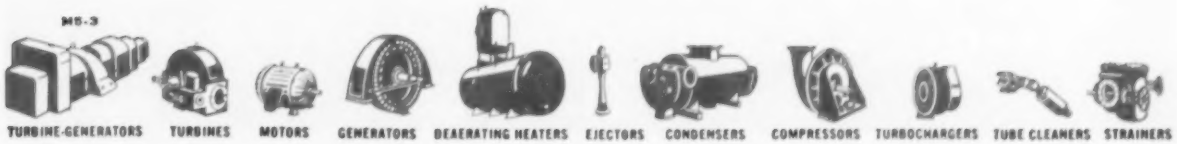
This 2120-hp engine in a diesel-generating power station gets a boost from the Elliott turbocharger.



EXPERIENCE MAKES THE DIFFERENCE...

It has been proved that turbocharging improves almost any diesel engine. It permits the engine to deliver more horsepower at lower fuel consumption. But be sure the turbocharger is an Elliott—the turbocharger backed by fifteen solid years of experience. Hundreds of thousands of hours of reliable operation in more than 12,000,000 hp of Elliott turbocharged engines on railway, marine, on-and-off highway trucks, stationary and heavy duty construction service stand behind today's product. It pays to specify Elliott turbocharging whenever you invest in diesel powered equipment. For complete details, write Elliott Company, Supercharger Department, Jeannette, Pa.

ELLIOTT Company



FORGINGS WORTHY OF FINE DIESELS

The perfection of modern diesel and gas engines warrants only the best of components.

Ellwood City forgings meet the most exacting requirements of today's engine builders and operators. As suppliers of high grade crankshafts, and other important forgings for diesel and gas engines since 1910 we have developed know-how and facilities second to none.

Send us your forging specifications. We will meet them with price and product.

SINCE 1910

Aerial view of our 10-acre plant devoted exclusively to the manufacture of best quality, precision forgings for forty-seven years.

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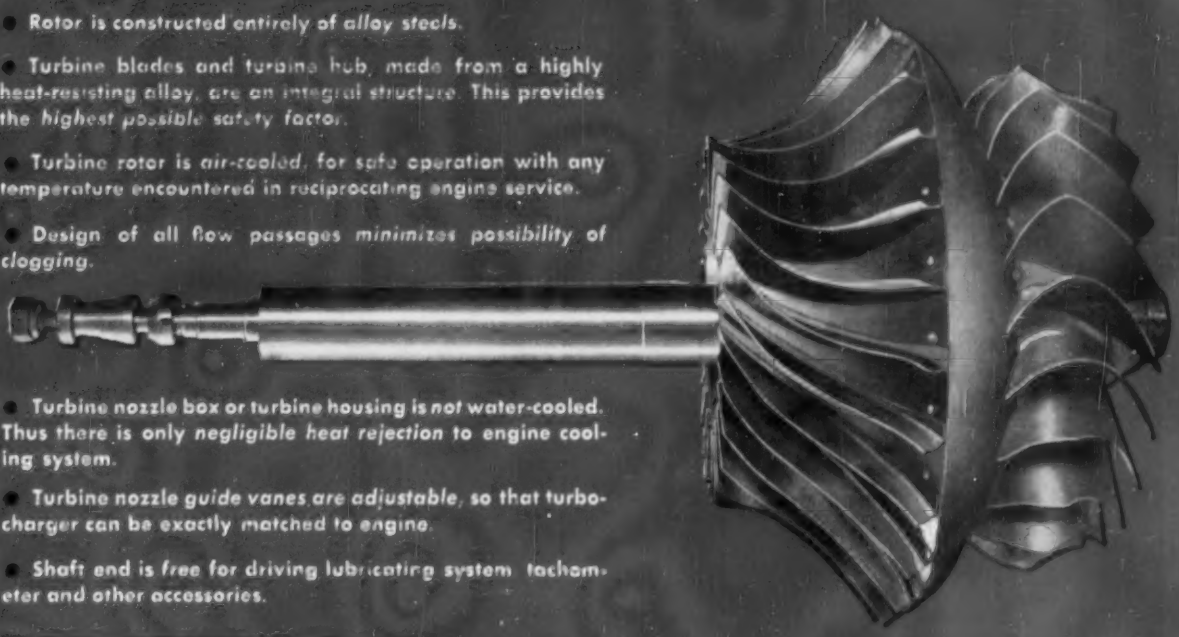
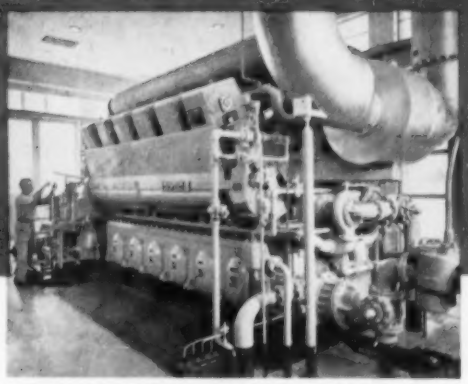
DE LAVAL
HIGH PRESSURE TURBOCHARGERS

increase output by 100% or more

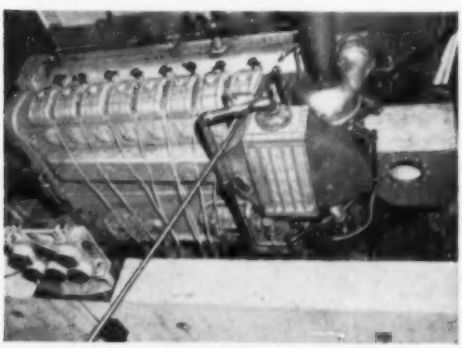
- Rotor is constructed entirely of *alloy steels.*
- Turbine blades and turbine hub, made from a highly heat-resisting alloy, are an integral structure. This provides the *highest possible* safety factor.
- Turbine rotor is *air-cooled*, for safe operation with any temperature encountered in reciprocating engine service.
- Design of all flow passages *minimizes possibility of clogging.*



- Turbine nozzle box or turbine housing is *not* water-cooled. Thus there is only *negligible heat rejection* to engine cooling system.
- Turbine nozzle *guide vanes are adjustable*, so that turbocharger can be exactly *matched to engine.*
- Shaft end is *free* for driving lubricating system tachometer and other accessories.



Here is a De Laval Type A-14 Turbocharger installed on a V 12-cylinder, 4-cycle diesel engine.



A De Laval Type B-8 Turbocharger, shown on test, is mounted vertically on an 8-cylinder, 2-cycle diesel.

Exclusive
MONOROTOR
construction shows why

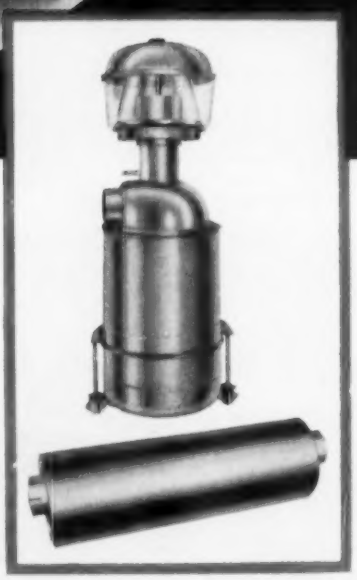
These De Laval high pressure turbochargers represent the newest development in diesel engine design. In many cases they can double the output of heavy-duty diesel, gas and dual-fuel engines without increasing thermal loading. • They offer pressure ratios of 3:1 as well as far higher compressor and turbine efficiencies than those found in conventional turbocharger systems. • De Laval turbochargers are self-adjusting to engine loads, can be used on 4- *and* 2-cycle engines. *Write for Bulletin 8000* giving compressor curves and flow range diagrams.

DE LAVAL
Turbochargers

DE LAVAL STEAM TURBINE COMPANY
890 Nottingham Way, Trenton 2, New Jersey

On most of the world's power equipment....

Donaldson Air Cleaners and Mufflers



The U. S. and Canadian manufacturers represented by these famous trademarks produce most of the world's heavy-duty engines, trucks, tractors and power equipment.

Most of them have equipped their units with Donaldson Air Cleaners from the time dust was first recognized as a serious threat to the progress of power.

The performance of Donaldson Air Cleaners and Mufflers under all conditions, Donaldson research and engineering, and efficient Donaldson production . . . are all parts of the "Follow-Through" service package which has made Donaldson a world leader in heavy-duty air cleaners and mufflers.

DONALDSON COMPANY, INC.

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"One of the best tool investments we ever made!"

The SIOUX Impact Wrench can easily cut nut running time to ⅓ of what it was by hand. When you think of the number of jobs requiring nut running, and the time involved, it's easy to see why men, who have been buying tools for a long time, say "It's one of the best tool investments we've ever made!"

Expect to cut your labor cost substantially with any impact wrench. Look to SIOUX for leadership in power, performance and endurance.

Model Number 325 **$ 99.75**
Model Number 330 **127.50**

The EXCLUSIVE

REVERSE CAP SWITCH LOCK

Prevents reversing with the switch on—eliminates burning commutator, brushes and switch contacts.

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for more information.....

SIOUX

USE SIOUX ALL THE WAY THROUGH

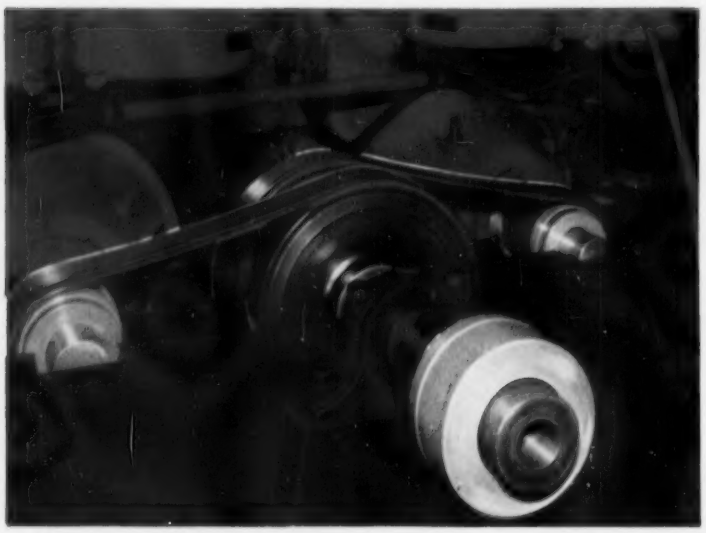
STANDARD THE WORLD OVER...

ALBERTSON & CO., INC.

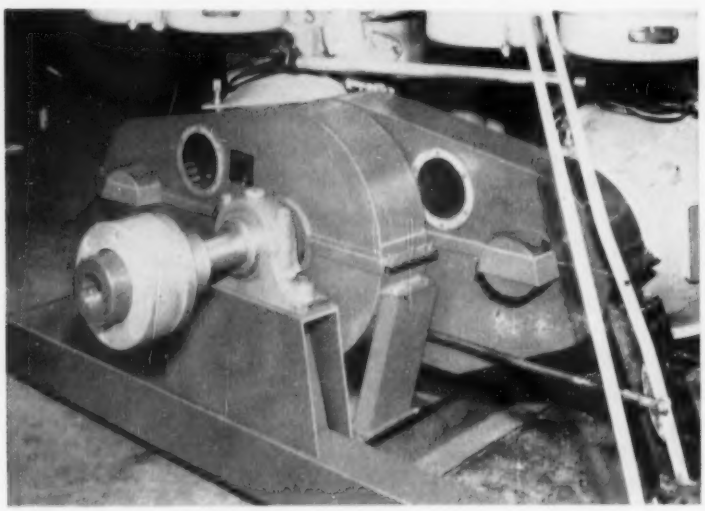
SIOUX CITY, IOWA, U.S.A.

ELECTRIC IMPACT WRENCHES • GRINDERS • FLEXIBLE SHAFTS • POLISHERS • DRILLS
HAND SAWS • SANDERS • VALVE FACE GRINDING MACHINES • ABRASIVE DISCS

Get Maximum HP Output from High-Speed Diesel Engines with Morse Hy-Vo Drives



Note the smooth action of Morse HY-VO in operation. Matched 182-HP diesel engines, operating at 1450 RPM, are twinned through HY-VO Drives to jack shaft, which operates at 650 RPM. Jack shaft delivers 364 HP to load shaft (not shown), to which it is coupled with Morse Morflex Radial Coupling (see below).



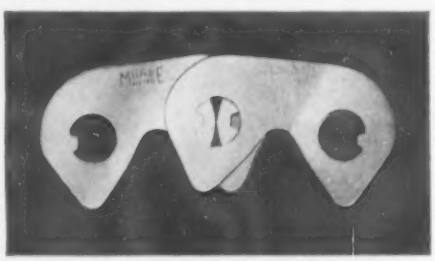
Twin HY-VO Drives are encased in sealed casings, permit continuous forced-spray and sump oil lubrication. Observation ports permit inspection. Morflex Radial Coupling cushions any shock loads from driven unit, prevents engine pulsations from entering driven shaft.

Southern Bearings Service and Lewis-Diesel Engine Company solved difficult cotton gin drive problem at low cost to customer.

Morse Hy-Vo Drives helped solve a typical power-transmission problem for Lewis-Diesel Engine Company (Memphis, Tennessee). Working with Southern Bearings Service, Inc., the local Morse distributor, they combined twin high-speed diesels with two Morse Hy-Vo drives to get low-cost, low-speed, high-horsepower output to a cotton gin main drive.

By compounding two small, high-speed diesel engines with required reduction ratios, the need for a big, expensive, low-speed engine was eliminated. Quick access to individual drive units was made possible without disturbing main compound base. Customer downtime is reduced to a minimum.

Compact Morse Hy-Vo Drives provide smooth, positive power transmission at speeds up to 8,500 fpm. They combine the positive action of gears with the favorable load distribution of chain; are rated at 20,000 hours' service life.



HY-VO Drive links, showing exclusive rocker-type joint. Rocker joint reduces wear and friction, results in coolest running chain drive.

Complete information free

For complete information and engineering assistance on Morse HY-VO Drives, contact your nearest Morse distributor. Write, wire, or call him today.

MORSE CHAIN COMPANY
INDUSTRIAL SALES DIVISION
ITHACA, N.Y.

MORSE MORSE BW* *Trademark **POWER TRANSMISSION PRODUCTS**

Surface inspection so valuable in the shop now can be extended as a field operation

Non-destructive Dye-Penetrant Method

Part to be tested must first be thoroughly cleaned for the Turco Dy-Chek process. Then, Penetrant is either sprayed or brushed on.

Surface flaw inspection can be done almost any place where surfaces can be exposed and cleaned.

INSPECTION to detect possible defects in maintenance and repair operations is important. Similar examination in manufacturing parts for new equipment is equally essential in many instances. Also it is a must for engine rebuilders.

Railroads have made notable progress in inspection procedures to safeguard lives, property and equipment, and to find defects in equipment parts before a failure occurs. To supplement and aid visual inspection, X-Ray, magnetic, fluorescent, and dye penetrant processes constitute most of the non-destructive methods of inspection.

History of Dy-Chek

Railroads were among the first to use contrast dye-penetrant inspection to detect flaws in metal surfaces. The Spanish Whiting and oil method for inspecting wheels and axles was the forerunner of the present Dy-Chek process.

Particularly aircraft and railroad engineers wanted a faster, more accurate method to detect minute heat cracks, fatigue cracks, and surface porosity in metal, both ferrous and non-ferrous. The whiting and oil method was considered a good basic principle; but crude. Therefore it was decided to apply more recently developed techniques to improve dependability. Penetrant was developed which would enter the most minute surface flaws, and a brilliant-red dye made the flaws more easily apparent to the eye.

After this Penetrant solution had been applied and given sufficient time to fill cracks or other surface flaws, it was necessary to remove all Dye Penetrant from the surface. A Remover was developed which would emulsify the Penetrant on the surface yet not enter cracks or other defects. For reasons of economy the penetrant was made water rinsable, so that large amounts of Remover would not be needed for rough surfaces.

To complete the Dy-Chek inspection process, a Developer was needed to draw the Penetrant from flaws to the surface for a precise indication. A powdered suspension was developed to indicate them clearly as bright-red marks on a white background. The speed and size of bleed-back gave important clues to the width and depth of the surface flaw.

Characteristics of Dy-Chek Materials

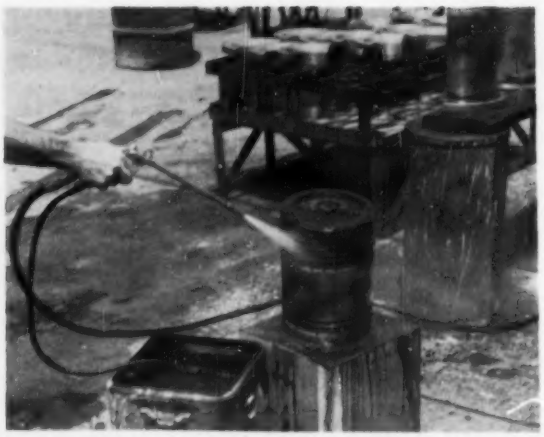
The Penetrant has an extremely low-surface tension so that it will enter the tiniest of cracks and pores. Its evaporating characteristics are such that when applied to a clean surface it will stay active and continue to penetrate for long periods of time.

The viscosity of the Remover-Emulsifier has been adjusted so that it will not enter flaws filled with Penetrant. Penetrant solution is removed only from flawless surfaces. Then Developer should be sprayed on the surface. If it is brushed on, it is likely to form a film which may mask fine flaws. Dy-Chek materials have no effect whatever on finished surfaces of metal, such as bearings, shafts, etc.

Some Applications of Dy-Chek

Typical railroad use is in steel wheel turning. In this operation, tread and flange truing in a wheel lathe is followed by brushing on Dy-Chek Penetrant. After removing the excess with a Remover-Emulsifier saturated

After a few minutes dwell-time, Penetrant is removed. Remover-Emulsifier must be sprayed or brushed on and part rinsed in water.



Water may be used freely to eliminate all traces of excess Penetrant without danger of removing Penetrant from defects.

Spray application of developer must be employed for a thin, even coating. Indications of sharp flaws appear almost instantaneously.

cloth, spray on the Developer with wheel still between the lathe centers. An ordinary paint-spray gun may be used for spraying on the Developer. Frequently a small crack will appear on face of tread within seconds. If the wheel still has sufficient metal above the limit another cut is taken deep enough to remove the crack. The wheel is then inspected again to make certain that all flaws have been eliminated.

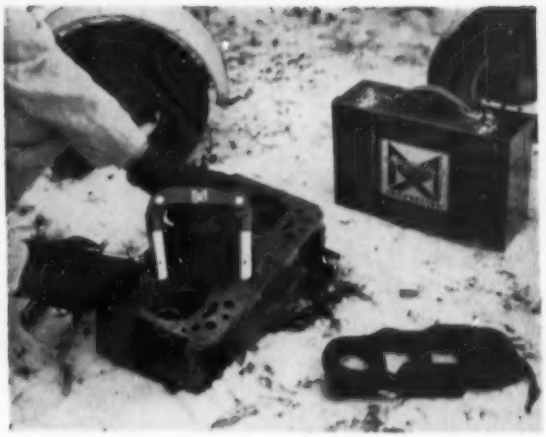
Small parts of diesel engines such as valves may be dipped into a tank of Penetrant solution. After a suitable time interval, dipping into Remover-Emulsifier, rinsing thoroughly with water, drying, and then spraying with Developer readies the part for inspection.

Examples of inspection of larger parts are also on hand. An aircraft manufacturer passes large aluminum wing spars through an installation of Dy-Chek tanks to disclose possible defects. An engineering company examines a longitudinal welded seam in a 48-in steel pipe by spraying Penetrant solution on the inside of the weld area. After about five minutes Developer solution is sprayed on the outside along the welded seam. At spots where the weld is porous the Developer draws the Dye Penetrant completely through the thick metal pipe wall. Red spots on a white background plainly indicate the location of defects.

Another use is the inspection of bus and truck wheel spindles without disassembly. After spindles are thoroughly cleaned the Dye Penetrant is brushed on and, after allowing for penetration, excess is removed. A small, portable Dy-Chek Kit for such inspections contains an aerosol spray bomb used to apply the Developer. Considerable money is saved by being able to inspect these spindles in the field. Compare the expense involved in the previous practice of dismounting wheel and axle assemblies and conveying them to shops where more elaborate apparatus is installed.

Still another and more speedy operation is connected with the use of a vapor-degreaser, using a material called "Chek-Spek". Processing begins by placing parts to be inspected in a vapor degreaser. Here, oil and soil are effectively removed and temperature of the parts is elevated to proper level for most efficient inspection. The flash-point of all materials exceeds 140°C. After removing parts from degreaser Dy-Chek Penetrant is applied by brush, spray or dip method, and allowed to remain from one to five minutes. The dye is then removed by returning work to the degreaser for 10 to 20 seconds. In this way the use of the Remover-Emulsifier is eliminated. Immediately "Chek-Spek" Developer is sprayed on the hot parts it dries, showing any flaw indications at once. The entire operation is carried out in from 3 to 8 minutes.

The complete Magnaflux YM-5 Yoke Kit with carrying case. Included are spray gun, powder bulbs, Magnaflux prepared bath, and powder.



Field inspection of parts is performed quickly and easily. Here, inspector looks for cracks in the head of an industrial engine.

A Portable Magnetic Inspection Device

Magnetic inspection of surface cracks can now be made in the field.

MAGNETIC inspection now moves into the field. Speed and reliability in locating surface cracks in magnetic materials and parts is achieved by use of Magnaflux Corporation's magnetic yoke, the YM-5 portable kit.

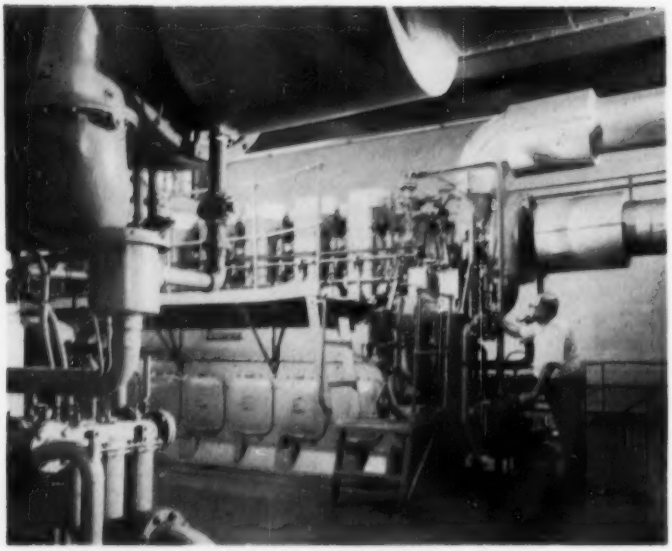
The two legs of the yoke are hinged and have soft iron angle-cut tips which rotate. Good magnetic contact can be made with almost any shaped part. Its permanent magnet elements are Alinco, and a new magnetic circuit developed by Magnaflux Corporation gives the YM-5 an especially effective magnetizing power for its weight. Magnetic pull is over 40 pounds on a flat surface, while the yoke itself weighs just five pounds.

In operation the yoke is placed on the work piece perpendicular to suspected cracks, and the inspection medium is applied between the legs. Indications of surface cracks will form immediately. While either Magnaflux dry powder or liquid bath inspection medium can be used, the Magnaflux bath is recommended in most situations. In some instances fluorescent Magnaglo may be the most desirable inspection medium. With a black light it offers more rapid inspection and greater sensitivity.

This device will find surface cracks of all types. Fatigue cracks, stress cracks, cracks from rivet holes, surface cracks in welds, corrosion cracking, and bending cracks in magnetic materials all can be shown quickly and positively. In addition it will find some subsurface discontinuities; but the reliability of this aspect is not stressed.

Its useful fields include maintenance and overhaul operations of all types where low cost and full portability make its use profitable and independence of power makes its use essential. It is particularly suitable for use wherever electrical arcing must be avoided, such as in refineries, chemical plants, ordnance plants and the like.

Adjustable leg hinges make YM-5 suitable for both large and small parts. All joints are spring loaded, requiring no resetting between test steps. Its unique "magnetic circuit" makes the yoke entirely self-keeping. It should not be necessary to replace, recharge, or disassemble the yoke for any reason.



Two 1240-kw diesel engine-driven generators at Tipp City's Municipal Power Plant carry peculiar load which results in power surge every two or three seconds. Engine speed, frequency and voltage fluctuations were corrected by means of electric governor.

Governing by Load-Sensing

By J. G. Gable Manager, Electric Governor Project Westinghouse Electric Corp., Buffalo, N. Y.

Tipp City, Ohio, municipal power plant has—or had—a problem. Equipment at one commercial account produced an estimated load surge of 750 to 850 kva each two or three seconds. Frequency control was tough. An electric governor embodying a new concept of speed and frequency control did the trick. Here are details of the governor and how it works.

IN generating closely-regulated power with engine-generator sets, rapid governor response is essential. A new electric governor provides this rapid response through an entirely new concept—anticipation of prime-mover speed change through load-sensing.

Moreover, this new governor permits automatic load-sharing when two or more generating sets operate isochronously. Sets will share their loads within 5% of a predetermined ratio. This is highly important in applications where normal load deviations exceed the capacity of one engine run isochronously with base-loaded units and where constant frequency must be maintained.

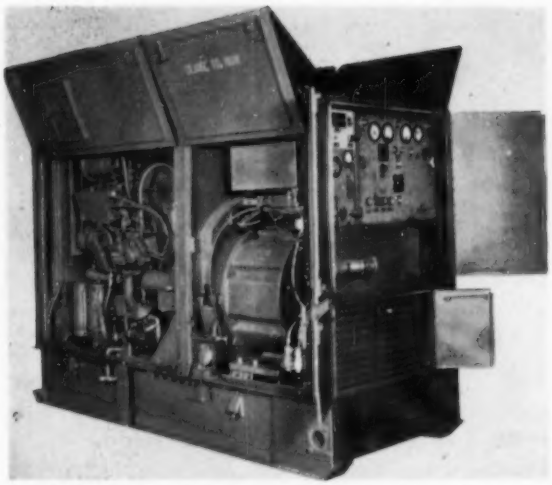
This new electric governor was developed by the Westinghouse Electric Corporation in cooperation with the U.S. Army's Corps of Engineers to meet both military and commercial needs. After extensive testing in both the laboratory and the field (Tipp City, Ohio, municipal power plant was an excellent proving ground), the governor was considered to have fulfilled all its design objectives.

What It Is and Does

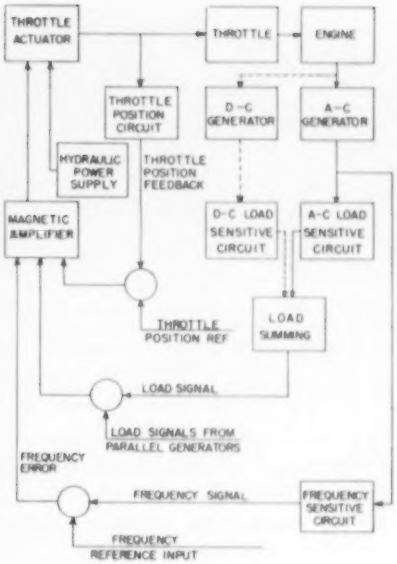
With the exception of a hydraulic throttle actuator and hydraulic supply, the new governor comprises an entirely static system of rugged electrical components. It differs from conventional governors that sense only engine speed in that it regulates not only on the basis of frequency (or speed) but is also able to anticipate imminent frequency changes by a continuous sensing of the instantaneous load on the generator.

Immediately that an increase or decrease in load is sensed, the electric governor acts to forestall any frequency deviations. Time required to return the system to the desired steady-state conditions is minimized. Frequency deviations are thus kept within very narrow limits.

The electric control unit serves as the information and decision center of the governor. It measures three variables: Generator frequency, generator load and engine throttle position. An electrical summation of these variables is magnetically amplified as a resultant error signal.



Cummins engine-driven generator set JSGA-601-45 is typical of military sets for which electric governor was conceived. Closer frequency regulation and isochronous paralleling features are important for many applications, both in the military and commercial.



Schematic shows how various elements of governor's electric and hydraulic systems work together in operation.

This error signal is applied to the hydraulic actuating unit—the muscles of the governor. Upon receipt the actuating unit converts electrical information into proportional hydraulic forces that act to position the throttle. Indicating speed of response, throttle change begins in approximately 0.015 seconds. Full travel occurs in an interval as short as 0.100 sec after application or rejection of full load.

In small, well-designed, high-speed engine-generator sets, this rapid response has produced typical maximum transient speed deviations of less than 1.5%. Recovery to steady-state conditions has occurred within one second after application or rejection of full load. These test results were obtained with sensitive low-damped, photoelectric laboratory recording instruments. Slower, more heavily-damped instruments of the switchboard type ordinarily fail to record any deviation at all.

Load-sensing and fast response speed provide an advantage over conventional governors that react to actual engine speed changes. Also, the governing function is free from the influence of oscillations and pulsations present in varying degrees in most conventional governor drives.

Details of Control Unit

The electric control unit, contained in a separate ventilated enclosure, is comprised of such stable components as transformers, rectifiers, resistors and fixed capacitors. Accordingly, circuits have long service life; they are not affected by shock, vibration or climatic changes.

Control units designed so far have been intended for 50/60-cycle and 400-cycle applications. Voltage inputs are designed for 120 volts, to permit direct connection to generators with 120-volt phase-to-neutral connections or to permit the use of standard potential instrument transformers with appropriate primary ratings. Current signal inputs are designed for use with 1- or 5-amp secondary current transformers. For large engine-generator sets, these instrument transformers are usually available in the generator control switchgear.

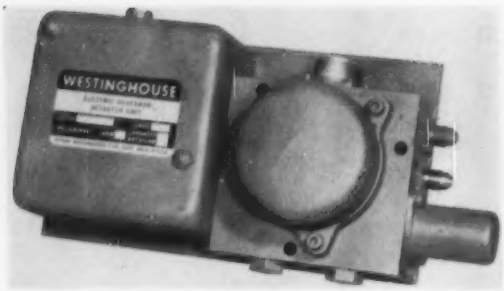
A closed-loop frequency circuit measures generator frequency to correct for any deviation from a set reference frequency. This circuit is a high-gain, low time-delay loop providing a high degree of accuracy under steady-state conditions and fast response under transient conditions. Its primary function is to counteract small frequency shifts at any specific load.

In further detail, this circuit consists of a frequency sensitive circuit and a frequency reference circuit of the discriminator type. Both circuits combine in effect to produce an output signal voltage proportional to the difference between the reference frequency and the actual operating frequency.

The frequency-sensitive circuit consists of a resonant L-C network combination whose output voltage varies with the frequency and which receives its excitation from the regulated phase of the generator. By proper tuning, the usable voltage range is placed on the essentially linear portion of the resonant curve. Output of the frequency-sensitive circuit is then rectified and impressed across a resistor to provide a d-c voltage proportional to frequency.

The frequency reference circuit is also excited from the regulated phase of the generator. This voltage is rectified and applied across a variable resistor to pro-

Governor control unit measures generator frequency and load, and engine throttle position. After integrating effects, electric summation is supplied to hydraulic actuating unit.



Hydraulic actuator unit receives intelligence from electric control unit as electrical signal and converts it into hydraulic pressures driving hydraulic piston and positioning throttle.

vide a variable d-c voltage independent of frequency.

Output signals from both circuits are compared electrically and any voltage difference then becomes the input error signal to the magnetic amplifier. In operation reference voltage is set to cancel the output voltage of the frequency-sensitive circuit when the generator is operating at the desired frequency. With any change in generator frequency, output voltage then varies above or below the fixed reference voltage and the resulting error signal, magnetically amplified, causes throttle movement to reduce the error and restore frequency.

Individually considered, the output of each circuit is directly proportional to the input or generator voltage. However, effect of fluctuation of generator voltage is nullified since only the *difference* between the two voltages initiates frequency change. Zero output signifies that desired steady-state conditions prevail.

A load-responsive circuit within the control unit functions to anticipating prime-mover speed change by measuring the generator load. It foresees the effect of generator load changes on prime-mover speed and repositions the throttle before engine speed has materially changed. With this time advantage, transient response of the system is improved to a great extent and recovery time shortened.

To accomplish this load-sensing, a-c generator loads are measured by a magnetic wattmeter circuit developed by Westinghouse. Small magnetic wattmeters or transformers measure phase current and voltage and produce an output signal proportional to the electrical load on that particular phase. Three such wattmeter circuits are required to measure a 3-phase, 4-wire unbalanced generator load. Since each phase is measured separately and load signals are added to give the total load, phase balance is not required for proper operation.

For combination-type 400-cycle engine-generator sets that include a d-c generator as an appreciable percentage of the total load, a d-c current-measuring transductor is used to provide a d-c load signal. When added to the a-c load signal this provides a totalizing load circuit to indicate the true mechanical load on the prime-mover.

Throttle position indication is the third basic signal from the control unit. Indication is provided by a throttle feedback system mechanically coupled to the throttle actuator.

This throttle follow-up circuit is used to stabilize the basic servo-loop and does so by supplying a voltage that is equal but of opposite polarity to the load-sensing signal. It is therefore a "null" system. In operation, at the instant of load change, the load-sensing circuit presents a signal proportional to this change and which creates a particular flux in the magnetic amplifier. The output signal produced causes the throttle to be moved in a direction to compensate for the load change. As the throttle moves, the throttle circuit furnishes a signal to oppose the original load function. When the correct throttle position is reached, the signal from the throttle circuit and the load function neutralize each other.

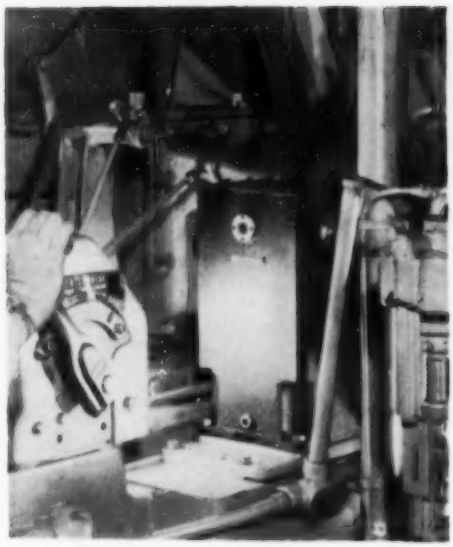
Since the load-sensing circuit gives a signal proportional to load which is nulled by the throttle position signal proportionally with throttle rotation, it may be seen that the relationship between throttle rotation and load at base frequency will be nearly linear. Slight errors in the linearity of the throttle are minimized by the frequency-measuring circuit.

The isochronous parallel operation feature, an operating advantage not previously available, constitutes a fourth circuit. If all engine-generator sets are equipped with the electric governors described, internal paralleling control can be used to permit all units to run on an isochronous basis. Each unit shares its predetermined portion of the total applied load.

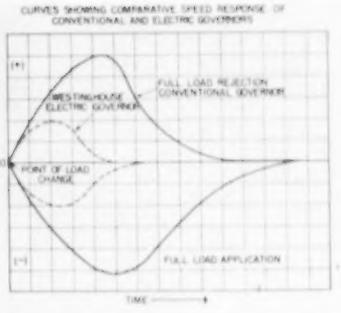
This is especially important where maximum load deviations on a system exceed the rating of the largest machine and frequency droop on increasing load is undesirable. To do this the load-sensitive circuit is used to indicate what percentage of the total load is placed on that particular unit. When the signals from electric governors operating in parallel are compared, any unbalance then operates to return the individual sets to the desired relationship.

As designed, this new governor has a manual control to adjust the individual unit to operate with a zero to 5% steady-state speed regulation. This permits units

Pump, filter and a 1-gal reservoir make up hydraulic supply which furnishes fluid at the proper pressure.



Governor casing houses both hydraulic actuator unit and hydraulic supply. Throttle positioning linkage is actuated by hydraulic pressures representing electrical output of electric control unit.



Resulting instantaneous response to load changes by elements of electric governor is shown in comparison to the speed response of typical engine-generator set equipped with conventional-type governor.

equipped with Westinghouse electrical governors to operate in parallel with units with conventional governors.

A magnetic amplifier heart of the electrical control unit, combines the various electrical signals according to their proper relationship into a single amplified output. This single output controls the simple hydraulic actuator which performs the mechanical function of throttle correction.

The magnetic amplifiers used are very similar in appearance to a small transformer. They provide a full-wave, push-pull output and have input windings for load, position, frequency and paralleling, in addition to a bias-control winding and an output winding.

Hydraulic Actuation System

The hydraulic actuating system receives its operational intelligence from the electric control unit. By converting these signals to proportional hydraulic forces, it acts through a piston to control the throttle. Included in this system are a sump, pump, relief valve, filter, actuator, linkage, and throttle position feed-back servo. These components may be designed in various configurations. Currently the actuator and hydraulic supply unit can be supplied as two separate packages, or as a completely packaged hydraulic system.

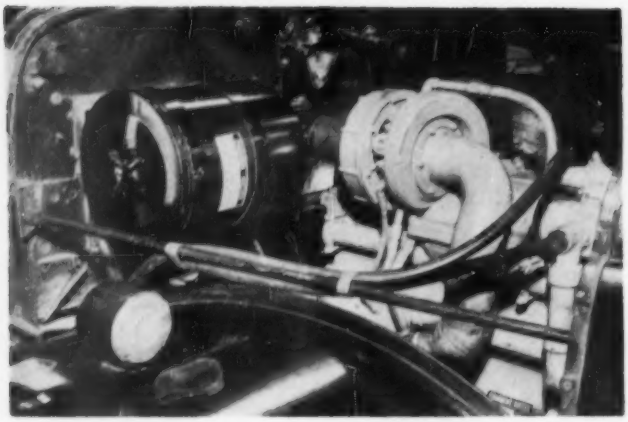
The actuator unit converts electrical output signals from the electric control unit into mechanical motion, for throttle actuation. In function, the actuator employs an electrical valve that integrates hydraulic pressure of the supply into two ports feeding opposite sides of a hydraulic piston or vane in a closed-loop hydraulic system.

Under steady-state conditions, these two output forces are equal so the piston is in equilibrium and does not move. But when frequency discrepancies require correction, the push-pull amplifier system causes the valve to unbalance this equilibrium and to raise the pressure on one side of the piston and vice versa. This unbalance causes the piston to move. Thus, piston position has no effect on its operation; it can be equalized anywhere within its limits of travel.

For throttle actuation, linear displacement of the piston or the rotary output of a rotary vane is transferred to the throttle by appropriate linkage. Mechanically tied to this output linkage is the throttle servo that relays electrically the throttle position to the position circuit of the electric control unit.

Though extremely rapid in operation and highly responsive, components are simple in construction. By use of a closed system, slight leakage about the piston and fluctuations or oscillations of the main hydraulic supply are inconsequential to over-all performance. *The hydraulic supply* merely furnishes the necessary volume of hydraulic fluid at the necessary predetermined pressure. It consists of a hydraulic pump with relief valve driven by a noncritical power take-off from the engine, a filter to exclude significantly large particles of foreign material and a fluid reservoir of approximately 1-gal capacity.

All of these components are of conventional designs obtainable in the open market. For outdoor operation in extremely hot and/or cold climates, hydraulic fluid per Military specification MIL-O-5606 (permitting operation from -65 to 125°F) is recommended. For normal indoor operation at moderate ambient temperatures, any good grade of SAE-10W motor oil may be used.



Truck installation shows turbocharger mounted on Model JT Cummins diesel engine. Air filter is direct connected to inlet of centrifugal compressor. Exhaust pipe can be seen on the discharge side of the exhaust turbine.

Turbocharging Vehicular Engines

Up-to-the-minute case history report outlines limitations, developments and achievements in applying turbochargers to current high speed, high output automotive vehicular diesel engines.

TURBOCHARGED high-speed diesel engines in vehicular service are now commercially acceptable, in fact very desirable. But they weren't always that way. It has taken a lot of hard, detailed work by a great many engineers to develop all the related items necessary to meet the requirements peculiar to automotive diesel applications.

What these problems were, how they were overcome and the direction of future developments in turbocharging high-speed diesels as it applies to one outfit, the Cummins Engine Co., is given in practically "case history" form in a paper recently presented before the Society of Automotive Engineers.

This paper is entitled "Turbocharging High-Speed, High-Output Diesel Engines" and was given by N. M. Reiners, director of research, and W. E. Woollenweber, design and development engineer, both of the Cummins staff. This up-to-the-minute report is the latest in a series that Cummins has presented on this general subject.

According to this case history, even as late as 1951 there were serious factors, primarily of an operating nature, limiting the application of turbochargers for vehicular service. One problem, for example, was poor torque characteristics for automotive service that were obtained, along with exhaust smoke at the lower end of working rpm range. Also, power response was slow with excessive exhaust smoke during acceleration. Then, the maximum allowable temperature and rpm of the turbine wheels of turbochargers of that time were also a limitation. Details from this paper of how Cummins tackled and eliminated each of these problems will now be discussed.

Torque Curve

Basically, the maximum power developed by an engine depends on the weight of clean air trapped in the cylinders. In naturally-aspirated engines or those super-charged with a positive-displacement blower (such as Roots) the air consumption is about directly proportional to the engine speed. Getting a torque curve on these engines suitable for automotive application is no particular problem. The dash-line curve in Fig. 1 shows what a desirable automotive torque curve should look like.

But with a turbocharger the energy available in the exhaust gas is less as the engine speed drops. This, plus a falling-off of the centrifugal compressor delivery characteristics as it slows down, is responsible for the inherent poor torque characteristics of the high output turbocharged engine. You just can't burn the fuel completely at the right time if your intake manifold air densities aren't high enough. According to this report such was the case especially at lower automotive engine speeds when using earlier model turbochargers on Cummins engines. The solid-line curve of Fig. 1 shows how the torque falls off at

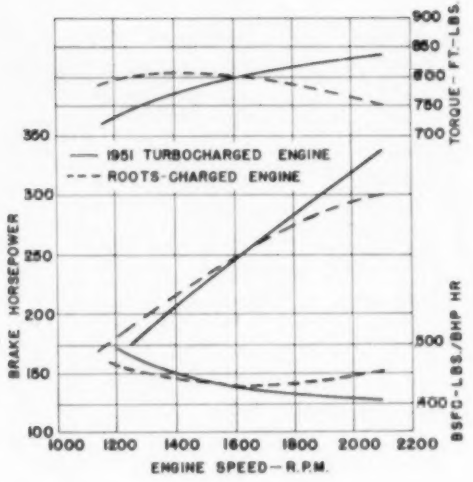


Fig. 1

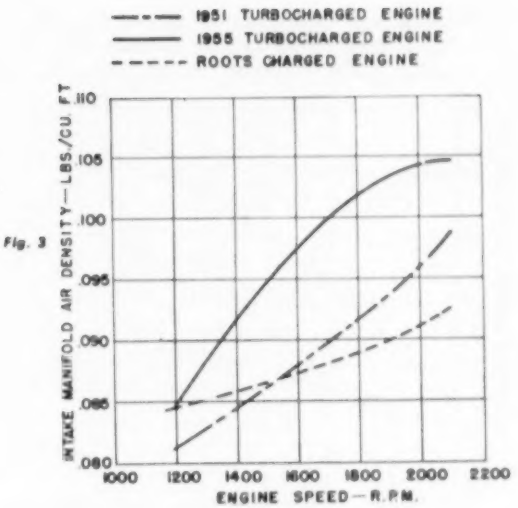


Fig. 3

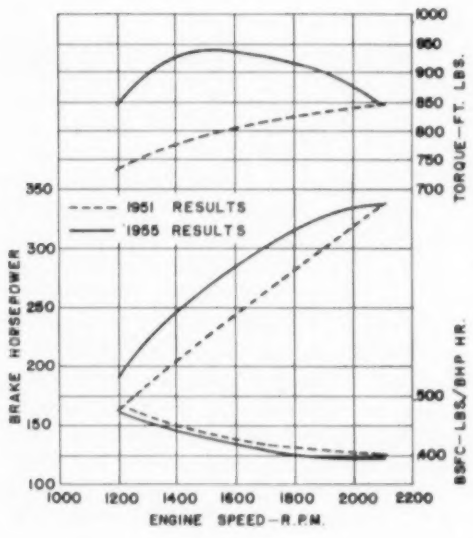


Fig. 2

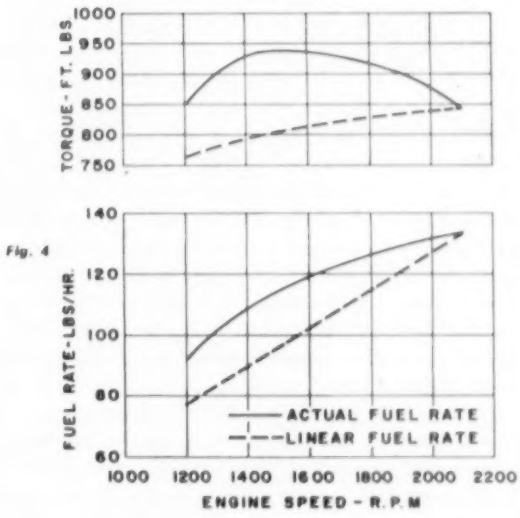


Fig. 4

lower speeds with earlier model turbochargers on Cummins engines.

To produce the same torque curve with a clean exhaust as does a positive-displacement blower, the manifold air density of the turbocharged engine must equal or exceed that of the Roots charged engine. The report states that the Cummins 1951 turbocharged automotive engine couldn't meet this condition below 1550-rpm. But as seen by the solid-line torque curve in Fig. 2, the 1955 version does meet this requirement down to 1200-rpm and produces the desired torque at all speeds above 1200-rpm.

This was accomplished by increasing the speed of the present turbocharger throughout the entire engine speed range above the maximum speed of the 1951 model turbocharger. This requirement of matching the air delivery of the Roots blower at lower engine speeds results in more excessive air from the turbocharger at higher engine speeds. In other words the inherent air delivery characteristics of the centrifugal compressor haven't been changed. Cummins has only designed their turbocharger to give enough air at the lower engine speeds and at horsepower outputs which produce the desirable automotive torque curve up to and including full speed, full load. Fig. 3 shows how the solid-line curve of the 1955 turbocharged engine meets the dash-line curve of the Roots charged engine at 1200 rpm, both engines having the same manifold air density at that low speed.

If more fuel were injected to use up this excess air present at full engine speed, 2100-rpm, a very high specific output engine would result. But this would give again the undesirable drooping torque curve at lower speeds. This leads to the second basic requirement of developing a desirable torque curve, the flexibility of the fuel injection system.

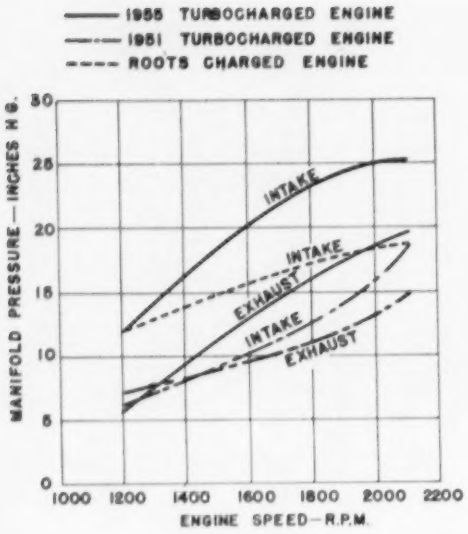


Fig. 5

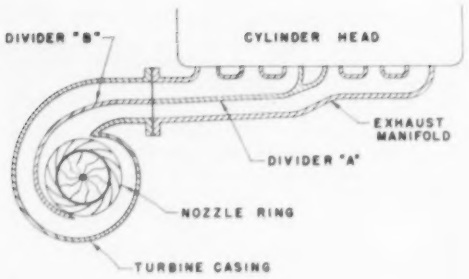


Fig. 6

Tailoring Fuel System

With a fuel system that produces a linear flow rate, in other words, one which at full throttle delivers a quantity of fuel directly proportional to the engine speed, the 1955 turbocharged engine had a drooping torque curve as seen by the dash-line curve in Fig. 4. The Cummins PT fuel system design and characteristics are so flexible, however, that the fuel delivery curve can be tailored to give the desired automotive torque curve as seen by the solid-line torque curve in Fig. 4.

These proper fuel pump delivery characteristics plus higher speeds of the turbocharger and its greater component efficiency produced a rising torque curve. The convex—shaped manifold pressure vs. speed curve (shown by the solid-line curve in Fig. 5), that results equals the Roots charged manifold pressure at 1200-rpm and exceeds it at all higher speeds. The 1951 turbocharged Cummins engine manifold pressure curve was concave as seen by the long and short dash-line curve in Fig. 5, and matched the Roots charged engine only at 2100-rpm.

Thus the inherent delivery characteristics of the centrifugal compressor have been changed to match better the engine air requirements throughout its working speed range. Also a favorable difference in pressure between the intake and exhaust manifolds shows up. For 25% less average exhaust pressure imposed on the engine at 1200 rpm, the intake manifold pressure was increased 50%. This remains constant over the entire speed range according to Reiners and Woollenweber. It means that the cylinders are now scavenged better at all speeds whereas the 1951 engine could only be scavenged at very high speeds. Only at this time did positive differential pressure exist. But it's at the low engine speeds that the largest amount of air density increase is needed.

Limiting Rotor Maximum Speed

Since the excess air present in the cylinder isn't used and is obtained only through higher maximum speeds of the turbocharger, attempts have been made to slow the turbocharger at higher automotive engine speeds. Several ways to do this were tried by Cummins.

The present model Cummins turbocharger has a nozzle with fixed blades. Thus the nozzle area is fixed and is one factor that increases the turbine rotor speed and pressure ratio at full load and increasing engine speed. In other words, this fixed turbine nozzle area which gives the necessary air for good combustion and torque at reduced engine speeds, overcharges the engine at higher speeds.

Now if a satisfactory variable turbine nozzle area device could be developed, the turbocharger maximum rotor speed could be reduced at higher engine speeds and the turbocharger would still supply the automotive engine air requirements. But for several reasons this development work has been left for future consideration by Cummins.

For one thing the mechanism can fail causing dangerous overspeeding in one position and low torque with excessive exhaust smoke and temperature in the other.

Another method of limiting turbocharger maximum speed and still get enough air for low speed torque is by using a waste gate. This would bypass some of the exhaust gas around the turbine at higher engine speeds only. This was also set aside by Cummins because it bleeds exhaust energy from the system and if it stays closed very high rotor speed results.

Using a positive-displacement type supercharger in series with the turbocharger was another way that Cummins tried to reduce rotor maximum speed requirement. A turbocharger having a lower maximum rotor speed was placed between the Roots charger and the engine. The Roots charger always supplies the air needed by the engine regardless of rotor speed. At high speeds the centrifugal compressor pumps into the engine all the air delivered by the Roots charger. The Roots charger works against little discharge pressure and doesn't take any horsepower from the engine except for friction and windage losses. At reduced speeds and full load, when the turbocharger output falls off, the lack of air is made up by the Roots charger. Added cost and complication doesn't justify the use of this system as yet.

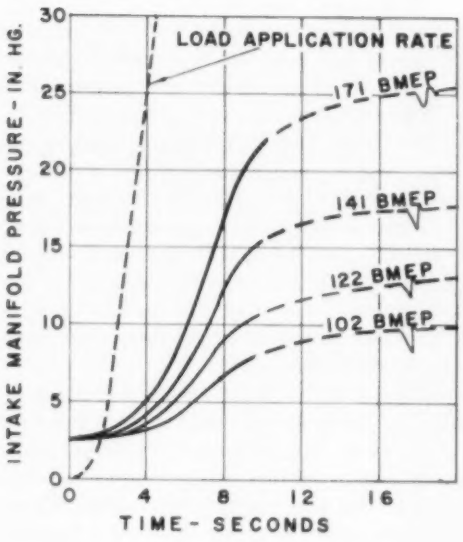


Fig. 7

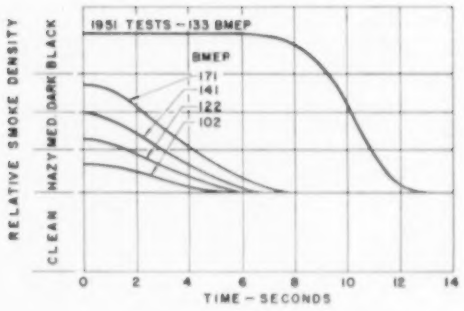


Fig. 8

Turbocharger-to-Engine Arrangement

In attempting to get the most efficient operating conditions for high specific output Cummins tried many turbocharger-to-engine arrangements. On 6-cyl engines, for example, three cylinders were made to exhaust into one section of the manifold and three cylinders into another section. The gas flow is thereby divided all the way from the cylinders to the turbine nozzle ring as seen in Fig. 6. Separating the consecutive exhaust pulsations in this way resulted in best cylinder scavenging and lower maximum exhaust temperatures. A 75% power increase over naturally aspirated engines was also possible without exceeding permissable exhaust temperatures.

It's obvious that effective scavenging is a must to get high output in high speed automotive engines. The highest possible pressure differential should exist between the manifolds during valve overlap. And the exhaust pressure should never exceed the intake manifold pressure. This determines the degree of scavenging and the results.

Valve overlap also has a bearing on the degree of scavenging. The less overlap the less scavenging. Also less turbocharger overall efficiency gives less manifold pressure differential resulting in less scavenging. Maximum scavenging removes more burned gases from the clearance volume and cools valves and cylinder parts better. It also lowers the exhaust temperature going into the turbine wheel permitting higher rotor speeds.

The more effectively the cylinders are scavenged the more the maximum engine rating can be increased by turbocharging. According to Reiners and Woollenweber a more detailed discussion of overlap, scavenging and manifold arrangement is beyond the scope of their paper. But they assert that best operating conditions can only be obtained by closely checking valve timing, valve lift, manifold pressure waves, manifold size and length and turbocharger overall efficiency. Only then can the best combination of all these interdependent factors be chosen.

Engine Performance

In Cummins' opinion, one of the most serious problems that retarded the turbocharged high speed diesel's acceptance for automotive vehicular use was excessive smoke and poor response during acceleration. The acceleration problem exists in these engines because the air supplied to the cylinders depends on throttle setting or the power developed at any given engine speed. On a Roots supercharged or naturally aspirated engine the air supply depends on engine speed and is independent of the power output of the engine.

Thus when opening the throttle suddenly on turbocharged engines, even though more fuel is injected the exhaust temperature or volume must increase before the rotor speeds up to supply the additional air required. The time lag between injection and the arrival of the increased air supply must be reduced to a minimum. This will reduce the acceleration problem and hold the exhaust smoke within commercial limits during this period.

Efficient use of exhaust gas energy plus low rotor inertia make the rotor accelerate quickly and helps cut the time lag between fuel injection and increased air delivery. Rotor inertia is strictly a design deal. However making better use of the exhaust energy depends not only on turbine efficiency but turbocharger-to-engine arrangement.

Extensive Cummins tests show that to shorten the time lag of rotor response the shortest distance between the exhaust valve and the turbine should exist. The manifold shouldn't have unnecessary bends. And the manifold diameter must be small to conduct high velocity pulsations to the turbine as fast as possible but not so small as to create undesirable pressure losses.

To get the best conditions, the turbocharger was directly mounted on the exhaust manifold. However, Cummins test curves in Fig. 7 show that regardless of the engine power rating it takes about the same time for the rotor to reach 70% of its stabilized speed and the smoke to clear up for that power setting. The reason is that at high bmep the rotor accelerates through a greater speed differential but the accelerating forces are larger. As the bmep is reduced both speed differential and accelerating forces are less.

However the smoke density during the initial acceleration increases with the bmep as seen in Fig. 8. This happens because of the momentary excess amount of fuel present

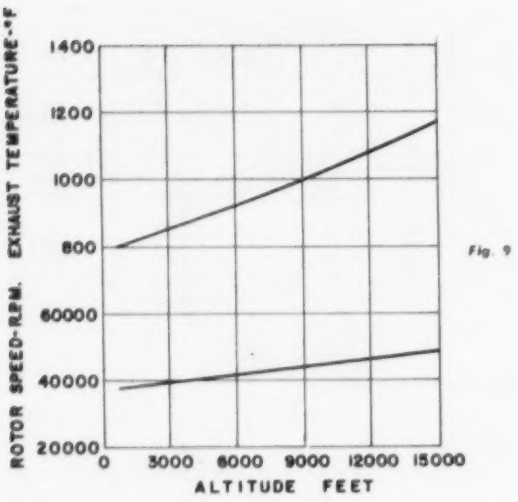


Fig. 9

without sufficient air to burn it. When a load is thrown on the engine, the governor immediately makes the fuel pump meter more fuel. But the additional air needed to burn this fuel completely isn't there until the turbocharger speeds up. The greater the load, the more fuel present without enough air to burn it, thus more smoke.

One of Cummins' ways of eliminating this trouble is to use an aneroid control device actuated by intake manifold pressure. Here only enough fuel to be burned cleanly is immediately injected upon sudden opening of the throttle. Additional fuel is automatically injected as the intake manifold pressure increases to the point where the fuel burns smoke-free.

Another way of doing this is by use of a combination turbocharger and Roots charger in series as explained previously. However neither of these methods have been adopted in Cummins' production engines as yet because of cost and to keep equipment simple. Instead they've done it by reducing turbocharger rotor inertia, getting best possible exhaust manifolding conditions and improving turbocharger overall efficiency. As maximum power demands increase they may have to resort to further refinements to keep the smoke within acceptable limits.

Altitude Operation

A Roots type supercharger doesn't compensate for high altitude density loss. A turbocharger can because it doesn't have a mechanical connection to the engine. Its compressor can increase its speed and pump an additional volume of less dense air into the engine. This speed increase takes place automatically and makes possible sea level power up to various altitudes.

This automatic speed increase at high altitudes depends on several factors. For example, less air density results in less power required to drive the compressor, thus a tendency for increased rotor speed. At constant intake air temperature the engine operates with less excess air and exhaust temperatures tend to be higher. This increases exhaust gas energy and rotor speed. Greater expansion ratio operation of the turbine due to reduced pressure at the turbine discharge also tends to increase rotor speed.

Cummins tests show that in the upper speed ranges a turbocharged engine can be operated at higher altitudes than a Roots charged engine before derating from maximum sea level power. But at 1200-rpm sea level the air density of the turbocharged engine is the same as a Roots charged engine. According to these tests then at the low end of the operating speed range the combustion of a turbocharged engine should suffer at altitude the same as the Roots charged engine.

Thus several serious problems exist when trying to maintain sea level power at high altitude. First you must have a high pressure ratio turbocharger with adequate speed capacity for operation without derating. And secondly although for high specific output the sea level power may be maintained at maximum speed it becomes increasingly difficult to maintain the sea level torque curve throughout the engine working speed range.

In simulating 15,000-ft altitude tests, Cummins used a turbocharger for altitude compensation to maintain sea level maximum power and torque over the operating speed range of a naturally aspirated automative engine. They found that as the altitude was increased (Fig. 9), the exhaust temperature and rotor speed kept rising when they tried to hold the sea level engine rating and torque.

Better scavenging, which can be obtained by more valve overlap, will lower the rate of this exhaust temperature increase which is one factor that determines the amount of rotor speed increase. The natural decrease in ambient air temperature with increased altitude can also materially effect the exhaust temperature rise and therefore the rotor speed increase.

Several special methods are now under consideration by Cummins to offset these exhaust temperatures if very high outputs at high altitudes are required. These include the use of an intercooler between the turbocharger compressor and the engine, and the use of the Roots supercharger and turbocharger in series.

Conclusion

As shown, the turbocharger is not only suitable for marine and stationary applications but for the automotive application as well. Turbocharger design has played an important role in removing some and extending other limitations to allow the full engine capabilities to be used. It will become more and more important and definitely influence the rating of vehicular engines operating at high altitudes.

Cummins is already producing a line of these high speed turbocharged engines which they claim are establishing an enviable record of performance and economy in highway operation. However, Reiners and Woollenweber conclude that they are only on the threshold. Future requirements and demands will require complete exploitation and use of the full potential offered by turbocharging.

Tractor moving bauxite ore in hold of ship. Concentration of dust obscures man at upper left. Engine failed every 100-hr; now runs over 570-hr with increased filtration efficiency. Bauxite's fine abrasive quality makes this operation an accelerated filter test.

Clean Intake Air = Overall Economy

You'll cut your down-time, replace fewer engine parts less frequently and operate your engine more economically by efficient air filtration.

AIR filtration pays off. And it is becoming increasingly important. Today, the ever-increasing engine output and higher rotative speeds require closer tolerances. It's just as important to keep the smallest possible materials out of the top end of the engine as it is to keep them out of the lube oil. Hence the perpetual battle against air-borne dirt.

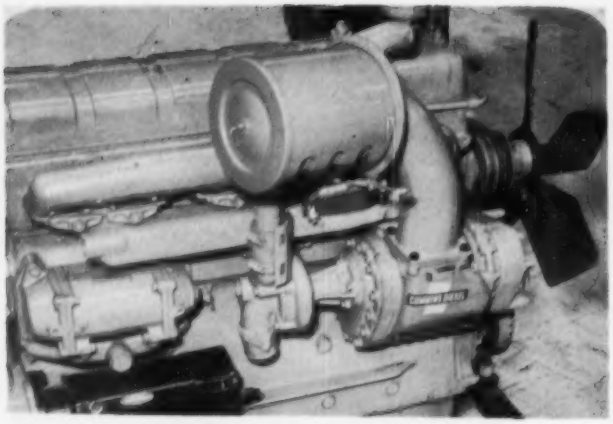
Practically all air filter manufacturers have concentrated on developing cleaners which would stop dirt particles as small as 1-to 5-microns from getting into the cylinders. It's the dirt particles in this size range that have always been the tough ones to remove from the air stream. The larger ones are removed quite easily. But these small ones, once in the engine, also cause excessive cylinder wear, piston ring sticking, piston ring and groove wear and lube oil contamination with all its accompanying ill effects.

Engineers have proven that of all the deposits on cylinder walls and in piston grooves, more than 40% is dirt coming in with the intake air. Much of this dust is of a silicate nature. Heat from the combustion flame fuses this material into abrasive glass-like particles. Filtration of air can reduce liner wear from about 25 to 90% depending on the amount and size of abrasive particles removed by an air filter.

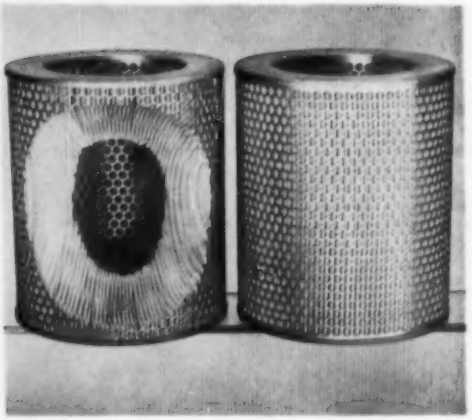
Piston ring life has also been correspondingly increased. It's almost axiomatic that the expense of a good filter is repaid in a short time through reduced maintenance. There's no question then but that every engine should have a good air filter providing micronic filtration. Data compiled by Purolator Products, Inc., (while using their dry-type filter), forceably emphasizes the results obtained when using air cleaners of different efficiencies and the need for high efficiency filters.

Dry-Type Filter Description and Operation

For those not familiar with this dry-type filter, it is a special resin-impregnated paper which allows air to pass directly through leaving dirt particles as small as 1 micron (0.00004-in) on the surface. The paper is treated to resist moisture, acids, oils and exhaust gases. Its surface area, which controls the overall restriction,



This is one way of mounting the air filter. Attaching directly to blower avoids the danger of leaks beyond the air filter.



Large filter area is achieved by convoluted cellulose. Design allows high volume passage at low resistance.

is such that inflowing velocities are kept low to maintain a high degree of filtration.

Getting a lot of surface area in a compact unit was accomplished by forming a convoluted cylinder of the cellulose in the housing. In addition to being designed for maximum filtering area it's strong enough to prevent collapse under differential pressure or damage due to a back-fire.

For example, one model has 2200-sq in filter area and can stand a differential pressure of over 20 inches of mercury. When clean it has a 325-cfm air flow with a pressure drop of less than 4 inches of water. An ordinary element of the same size has only 144-sq in filtering area.

With this surface-type cleaning, particles seldom stick to the filtering medium. Some cake may build up but it falls by its own weight or when loosened by normal engine vibration. Filtering efficiency is actually increased should any small dirt-cake exist around the element, providing it doesn't restrict air flow. This self-cleaning characteristic lengthens the time between filter changes. Trucks using these filters are reported to operate from 20,000 to 50,000 miles before servicing the element.

Service life of the element can be determined easily by checking restriction across the filter. When the allowable maximum restriction is reached the element is cleaned or replaced. One large manufacturer of automotive engines using these filters is contemplating the use of an electric vacuum gauge to measure a pressure drop across the filter to determine when to replace them. If only cleaning is necessary, simply remove the element and blow low pressure air in reverse of normal air flow.

Micronic Filtration Data

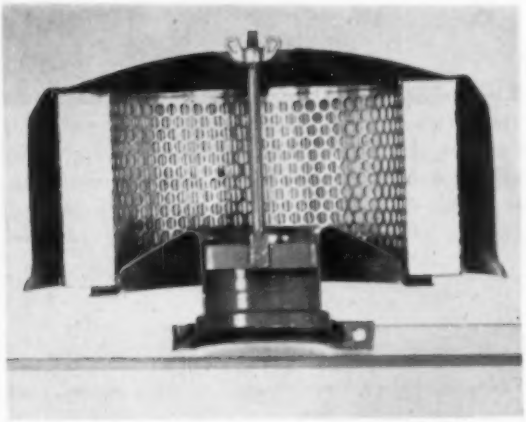
The importance of micronic air filtration and its favorable results on engine overall economy, down-time and wear of parts is emphasized by many field tests. One analysis, made by a bus company, of particle sizes trapped by dry-type filters used on their engines shows that 73.8% were below 2 microns. Another 16.7% fell in the 2-5 micron range while about 10% of the remaining particles ranged from 10 to over 80 microns. The high percentage of dirt particles removed in this low micron range (less than 2 microns) is what we're after. It is these minute particles which slip through low efficiency filters and cause the damage.

Another analysis, this time on an element removed from a diesel dump truck after 223 hours of service, showed that 71.9% of the particles were below 2 microns, 19.5% from 2-5 microns and less than 10% were from 5 to more than 80 microns. The removal efficiency in this case is 99.8% and is typical of the service given in other installations.

High efficiency in this smaller particle range is the big factor in reduction of engine wear. One method of efficiency evaluation is analysis of crankcase oil samples taken from engines using different filters. A comparison was made by Purolator Products, Inc., of oil analyses from a large number of fleets after 20,000 miles of operation. Here are the results.

	Dry-Type Air-Filter	Other Air Cleaner
Fuel Dilution	2.2	3.4
Water	1.0	3.5
Gums (Sludge)	8.4	12.8
Fuel Soot	8.5	12.0
Carbon	1.5	7.0
Abrasives	1.0	10.2
Rate of Combustion Waste	5.5	7.9

From these figures it's apparent that fuel dilution, water, sludge, fuel soot, carbon, abrasives and combustion waste were found in noticeably smaller quantities when the dry-type air filter was used. This analysis also showed that less oil filter changes were required as a result of less contaminants in the crankcase. Again, the importance of high efficiency air fitration is emphasized by these tests.



Casing and element are designed as unit. Casing edges are specially sealed to prevent leaks.

Considerable maintenance savings also resulted from these 20,000 mile field tests. Down-time was cut since there was less damage to rings, bearings and other parts. In addition, these tests also pointed out the importance of mounting the filter directly to the manifold or blower in some cases. This minimizes dirt leakage beyond the element. Filters which can be used either vertically or horizontally facilitate this type of installation. And space limitation under the hood can be used to best advantage.

Results of using various air cleaners on a tractor diesel moving bauxite ore further stresses the significance of high efficiency filtering. Engine failures after 100 hours had been traced to this extremely abrasive dust. Purolator Products, Inc., laboratory tests showed that when the dry-type filter was used it removed 99.93% of all the bauxite. Particles below 2 microns made up 92.11% of this dust.

The service life of the two manifold-mounted filters, which in this case were installed in series, was twice that of air cleaners previously used. The manifold remained dust free up to 570 hours of engine operation and the engine showed no loss of power. This gives further proof of the type of pay-off you can expect when getting high degree air filtration.

Conclusion

These and other field tests plus many actual operation results have convinced numerous fleet operators that micronic air filtration means large savings. And experience with higher efficiency air cleaners on their engines have proved it. By getting practically dirt-free air in their engines they have increased overall power output and cut engine down-time, a considerable item on the fleet owner's balance sheet. This together with the actual dollars and cents saved by less frequent replacement of cylinders, pistons, rings, bearings, lube oil and oil filters makes micronic air filtration a thing worth while striving for.

Drain That Anti-Freeze

IT'S about time to get that engine's cooling system ready for hot-weather duty. Unless you give it proper servicing after the winter's use, you are asking for trouble. There will be times when peak cooling efficiency is required just to sustain normal temperature limits. And overheating can cause serious damage.

Servicing procedures are simple and when properly done will avoid expensive repairs and costly down-time of the equipment. This is particularly important in the case of construction-type equipment and allied machinery since the summer months are when they usually work the hardest.

You can insure efficient cooling by following a few simple steps:

1. Drain the system and *discard the antifreeze.*
2. Flush system using a chemical cleaner if necessary.
3. Check out the system including thermostats, water pump, hoses, etc., correcting items as necessary.
4. Refill with clean, soft water *and add inhibitor.*

Note the italics; these items tie in together. If you are thinking of continuing your anti-freeze in service—don't. Even the ethylene glycols (so-called "permanent"—type anti-freezes) should be discarded.

The National Bureau of Standards recommended this practice as far back as WW II days, when shortly after Pearl Harbor the SAE organized committees to study motor vehicle maintenance for Government agencies. Dupont with their Zerone and Zerex and National Carbon and Carbide with their Prestone have advocated this, the former re-affirming it just recently. It's not just to sell more anti-freeze; it's for your protection—a product information service.

Here's where the second italicized item ties in—inhibition. Practically all commercial anti-freezes contain rust inhibitors, making it unnecessary for you to provide this protection in the winter. In time, rust inhibitors are depleted and the solution turns acid.

Corrosive solutions soon produce rust and scale in the entire system and the engine quickly overheats. This causes more serious damage: scored cylinders, warped cylinder heads, burned and sticky valves, etc.

There is no easy-way to check acid concentration. It requires an expensive laboratory test. It is more economical to discard a solution after one winter.

Why Exhaust Smoke?

In over-the-road operation, some diesels smoke and some don't. What factors affect this smoke condition? Is it fuel? Or engine condition? Here are results of a study of the influence of these two factors on the condition. These are things that you should know to help you get out or keep out of trouble.

THERE is an increasing public awareness of engine exhaust gases, both gasoline and diesel. Complaints run from objection to their odor to blaming smog on them. Rightly or wrongly, it adds up to a public relations problem. Unfortunately for the diesel, its exhaust gas sometimes appears as visible smoke so it takes the brunt of the blame.

Proof of this is seen in efforts made in some areas to write legislation controlling diesel exhaust smoke. However, before anything really constructive can be done about the problem, a good deal more information is needed. How do you set up an acceptable smoke standard? What are the reasons for smoking? Are these reasons in the realm of the operator?—the fuel supplier?—or the engine builder?

It's no good passing the buck to the other fellow. When it is you versus John Q. Public, you better do something or you'll be continually in hot water. A typical example and constructive results are seen in the case of exhaust noise. The trucking industry accepted this as a problem that had to be tackled and, after working with the truck builders and accessory manufacturers, voluntarily adopted the 125-sone noise-level standard. This set the basis for ultimate control of the problem.

While there is some degree of similarity between these two problems, the smoke problem is by far the most difficult of solution. It will only be licked by a cooperative effort to bring out all the facts.

Engine builders design engines capable of smokeless operation. Most modern engines will pull substantial overloads on the test stand before reaching the smoke limit. Yet in the field some engines, even of the same make, smoke and some don't. However, this does not completely absolve the builders, shifting the onus to the operators. Some engines are more smoke-critical than others, perhaps at some point in their speed and load range. This leaves room for design improvement.

Builders can help others (and themselves) by getting and sharing data relative to the effects of application, operation, engine condition and different fuels on exhaust smoking. They're in this thing up to their ears because when a diesel smokes, no matter what the cause, it's their name on the nameplate and they take the rap.

Operators have a big stake in licking the problem as they take the brunt of public opinion—and in some areas, face punitive action. They have to know the factors involved before they can take remedial action. They must understand the effects of overloading either through excessive vehicle loads or vehicle underpowering. Also, the effects of operational faults such as lugging.

They must appreciate the importance of proper maintenance if smoking is to be avoided. And they must also get all the help possible in keeping their engines in good condition. There is a double incentive here for the operators since good maintenance will also reduce operating costs and provide greater horsepower.

Fuel characteristics are known to have some effects on smoking so that brings the oil companies into the picture. They have a wealth of information on the subject and are getting more. For example, Mr. W. A. Howe of the Gulf Oil Corporation reported the results of extensive testing at the SAE Golden Anniversary Diesel Engine Meeting, St. Louis, Mo. in Paper No. 631.

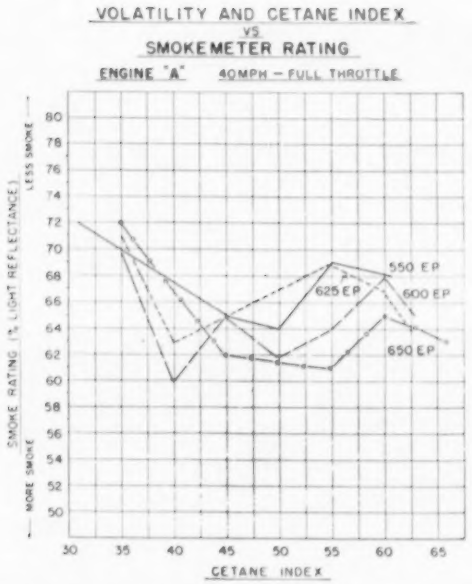
The title was "Factors Affecting Diesel Smoke in Highway Operation". It is a detailed report of a study made ". . . . to obtain additional information from a practical standpoint and also at the request of a large over-the-road diesel coach operation." The objective was "To determine the effect of certain fuel and engine characteristics on exhaust smoke . . . ."

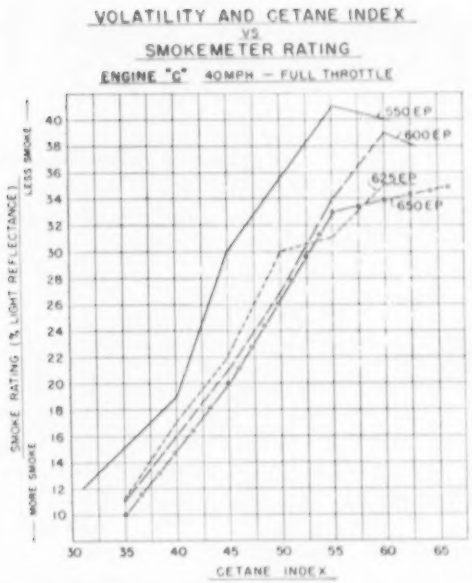
Since some of the results obtained bear so closely on the subject under discussion, portions of the paper will be abstracted. Get the paper, though; it's well worth going through in detail.

Test Procedures

Tests were conducted over a period of approximately a year in both Pittsburgh, Pa., and Dallas, Texas, with weather mostly dry and ambient temperatures varying from a low of 83°F to a high of 116°F. Three engine makes were used. Two 4-cycle units were installed in over-the-road tractors and a 2-cycle engine was installed in a coach. All were 6-cyl engines. One 4-cycle unit was normally-aspirated; one was turbocharged; and the 2-cycle engine had a mechanical blower.

Vehicles were tested on different Clayton chassis dynamometers (a total of four were involved) so no direct engine-to-engine comparisons were made, although results were relative for each engine. Tests were made to determine effect of fuel on smoke intensity and effects





Only a few of Mr. Howe's 28 charts are shown. These two illustrate findings with respect to volatility and cetane index versus smoke meter ratings for a normally aspired engine and a turbocharged engine under identical operating conditions. Engine "A" chart indicates that, in general, smoke increases with fuel weight and that the engine is relatively insensitive (smoke-wise) to cetane index. Low smoke rating at lower cetane index is attributed to possible detonation giving additional heat for combustion. It could not be tolerated for continued operation. For reference, smoke ratings from 55 to 70 have a visual rating of "Trace". Above 70, "None". In engine "C" chart sensitivity to cetane index is shown. Engine is less critical to volatility of fuels with end-points of 600 F and above. Smoke rating from 12 to 27 are visually "Heavy"; from 27 to 41.5, "Medium".

of fuel characteristics on horsepower. A total of 46 different fuels were used. Effects of engine condition on smoke intensity and horsepower were also determined.

All engines were well instrumented to insure identical conditions during successive tests. Smoke records were obtained by the continuous-recording, tape-type smokemeter. Of course, detailed data was developed within the broad scope of the tests. All that will be reported here are some of the conclusions drawn after detailed results were evaluated. They will serve to indicate the trend of the effects to be expected as fuel characteristics and engine conditions change.

Fuel Effects on Smoke Intensity

In listing results under this heading, Mr. Howe summarized the effects of three fuel characteristics and the influence of fuel type. Here are his comments:

Volatility—As the fuel's end-point increases (becomes less volatile) the tendency to produce exhaust smoke is increased.

Cetane Index—As cetane index increases from 45 to approximately 60, the tendency to produce exhaust smoke is reduced. However, the effect of cetane index on exhaust smoke varies from relatively little in some engines to major proportions in others.

Sulfur—Fuel sulfur content varying from 0% to as high as 0.7% does not affect diesel exhaust smoke.

Fuel Type—Based on the solid material in the exhaust gases as shown by the smokemeter, the cracked fuels tested did not differ materially in smoking tendencies from highly paraffinic or straight-run fuels of the same volatility and cetane index.

However, visual observation shows that some cracked fuels produce a visible smoke starting from three to five feet behind the tailpipe to as much as 15 feet away.

Fuels as Affecting Horsepower

Effect of fuel characteristics on horsepower was not the major objective in the testing program. It was included to evaluate generally accepted ideas that use of relatively heavier fuels permits greater output. Mr. Howe states that "These ideas can, and may have, resulted in the use of fuels which give more exhaust smoke than necessary." Here are his findings:

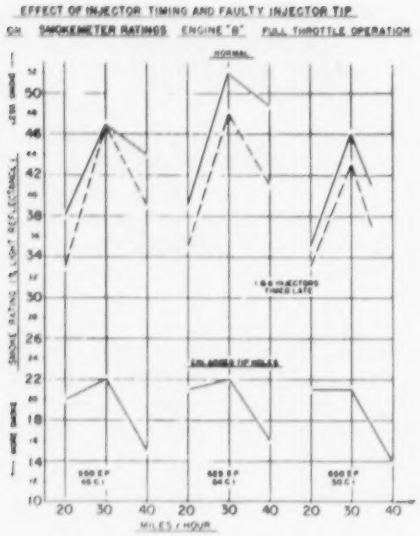
Volatility—Some engines realize greater horsepower from less volatile (heavier) fuels while others obtain greater horsepower from medium-volatility fuels. Volatility alone is not necessarily a criterion of horsepower available from fuel.

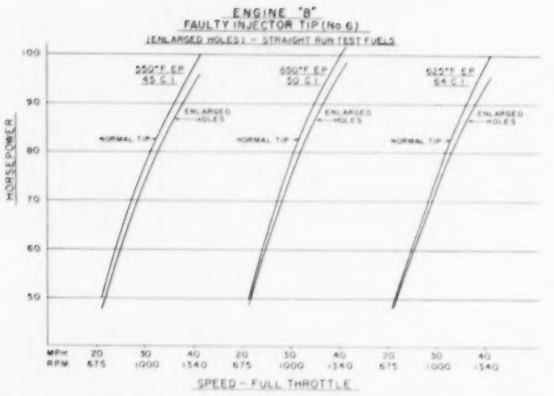
API Gravity—Some diesels are more sensitive to horsepower increase with a reduction in API gravity than are others.

Cetane Index—As cetane index increases, horsepower is reduced.

Fuel Viscosity—Again, it depends on the engine. In some engines, the more viscous fuel will not give the greatest horsepower while in others, the higher the fuel viscosity (within reasonable limits) the greater the horsepower obtained.

Granting that these findings are on the maybe-yes, maybe-no side, they do demonstrate the fallacy of making categorical assumptions. Summarizing his findings, Mr.


EFFECT OF INJECTOR TIMING AND FAULTY INJECTOR TIP
ON SMOKEMETER RATINGS ENGINE "B" FULL THROTTLE OPERATION
NORMAL
1 NO. INJECTORS TIMED LATE
1 NO. INJECTOR TIP HOLES
MILES / HOUR



Charts showing effect of two faulty engine conditions on smoke and horsepower. At left, normal smoke rating (top solid lines) with three test fuels at 20, 30 and 40 mph are shown. Lower dashed line shows effect of late timing on two cylinders. Effect of one bad injector tip (bottom curve) nullifies any quality characteristic of fuel. Effect on horsepower is seen above.

Howe states ". . . . that a highly paraffinic or straight-run fuel with an endpoint up to 625°F and a cetane index between 45 and 55 will perform very satisfactorily in over-the-road operation of automotive diesel engines.

"The recommendation and use of such a fuel, on one hand, should result in savings in fuel costs over the kerosene-type fuel for some operators. On the other hand, it would tend to decrease use of a heavier and perhaps highly-cracked fuel with a resultant lowering of maintenance costs by other operators. It is suggested that a diesel fuel of this nature be considered as an ideal compromise fuel for all automotive diesels in over-the-road operation to minimize smoke with little, if any, sacrifice in horsepower. Such fuels are becoming increasingly more available in all areas."

Engine Condition Effects on Smoke Density

It's pretty obvious that poor engine conditions will affect completeness of combustion and hence smoking. But what are some of the factors and the trends of their results? Here are some of Mr. Howe's findings:

Road Speed—Depending upon the method of air supply to the engine, some smoke more at lower speeds and others smoke more at higher speeds. In short, it largely depends on how good a job the engine builder has done in providing adequate air in relation to the fuel injected throughout the engine's operating range.

Amount of Fuel Delivered—The air-fuel ratio is probably the most critical feature in exhaust smoke intensity. A relatively small difference in the amount of air delivered appears to affect exhaust smoke intensity more than 100°F difference in the end-point of the fuel.

Fuel Injection Timing—Late injection timing can also adversely affect exhaust smoke intensity, more so than a difference of 75°F to 100°F in fuel end-point.

Injector Condition—One faulty injector tip in a 6-cyl engine may cause heavy exhaust smoke with any fuel and thus nullifies any quality fuel characteristics such as cetane index or volatility.

These findings show the extravagance of purchasing high quality fuels only to nullify their value through poor maintenance practices. There's another side too.

Engine Condition Affects on Horsepower

Factors that affect exhaust smoking rob the engine of horsepower, providing the second incentive for operators to set high maintenance standards. Mr. Howe cites two:

Loss of Air—Reduction in air supply can appreciably reduce the horsepower delivered. This can be due to such factors as a plugged filter or in pressure-charged or turbocharged engines, an air leak or decreased efficiency in the means for supplying air.

Faulty Injection—Improper timing or mechanical troubles such as the faulty injector tip mentioned interfere with proper combustion. This can reduce horsepower as well as contributing to smoke intensity.

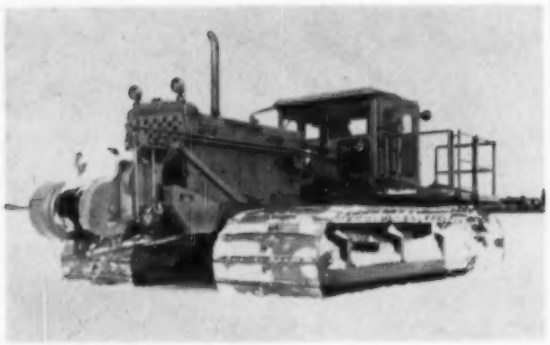
Emphasizing the importance of engine condition to the exhaust smoke problem, Mr. Howe concludes "Diesel engine operators must maintain a continual surveillance of engine condition as engine malfunctioning can produce more exhaust smoke than the quality characteristics of diesel fuels now available for commercial use."

Summary

Exhaust smoking in over-the-road vehicular applications is a serious public relations problem. Its solution is complex, involving engine design, application, operation, maintenance and fuel characteristics. This cuts across at least three areas of responsibility—engine builders, operators and the oil companies.

Someone is credited with saying, "There are no problems, only lack of facts." If this is accepted, the solution to this problem lies in a cooperative effort to determine and make available the facts. The data presented is a step in this direction.

news of our industry



Low Ground Pressure Tractor

Towing "trains" of supplies and material over soft winter snow and summer muskeg in the Arctic has been made easier by a low ground pressure tractor. This tractor was developed by the Corps of Engineers' Research and Development Laboratories, Ft. Belvoir, Va. and made by Peterson Tractor and Equipment Co. of San Leandro, Cal.

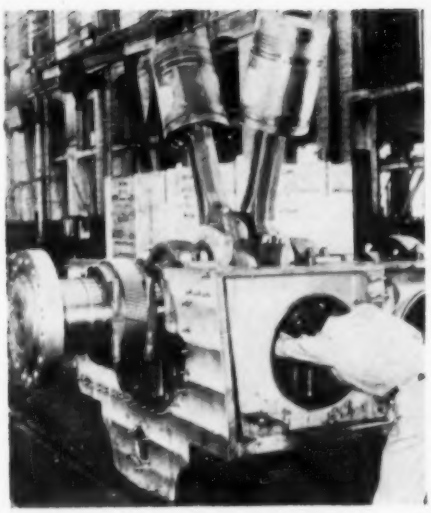
Made essentially of parts from a conventional tractor, it has a unit ground pressure of only 3.4 psi. This is almost 5 psi less than that of its standard counterpart. Powered with a 6-cyl, 225-hp diesel, the tractor has an extended frame which provides a track 160-in long on the ground. Track "shoes", 54-in wide, make the extremely low ground pressure possible.

The tractor has standard controls, steering clutches and transmission. It also incorporates a torque converter with a manual locking device and a cab which gives the operator comfort and protection.

A smaller version of the tractor powered by a 195-hp diesel has also been developed. This tractor has 36-in wide track "shoes" which give it a unit ground pressure of 4.15 psi.

Both tractors towed heavily loaded sleds during U. S. Army Transportation Corps' tests on Greenland Ice Cap and at Houghton, Mich. These tests show the tractors may provide the Armed Forces with a comparatively slow but effective Arctic "locomotive".

A unit ground pressure much lower than that of standard commercial tractors is needed for successful cross-country operation in the Arctic. Improper weight distribution and lack of flotation make the standard tractor inoperable in the soft snow and muskeg.



Worthington's SW 14 Turbocharged Engine

Emphasis is placed on simplicity of construction and accessibility in Worthington Corporation's newly designed SW 14 vee-type turbocharged engines. These engines range from 1350 to 5000 hp.

Preliminary adjustments of large pistons and inspection of bearings through large crankcase doors shows ease of accessibility to internal parts.

This engine will be installed at the Auburn, Neb. Municipal Power Plant.

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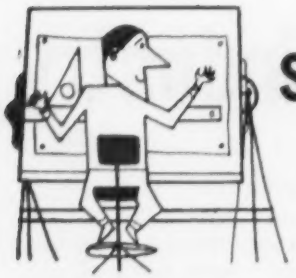


service section

Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you

International-Harvester UD-1091 Oversize Exhaust Valve Seat

To assure maximum valve and valve seat insert life it is essential that the insert be installed to obtain maximum contact with the bottom and sides of the counterbore. In this way only can the proper heat dissipation be obtained through the head.

In the event inserts are not sufficiently tight there is the possibility they will work loose allowing carbon to collect on the outside of the insert thus preventing good dissipation of heat through the head.

The cylinder head must be machined to a depth of 0.423 to 0.427-in and to a diameter of 2.200- to 2.201-in, after cleaning the sides and bottom of the counterbore, to assure a good tight fit. After the insert rings and suitable driver tool have been chilled with dry ice for about (½) one-half hour, a few light blows with a hammer should set the ring in place. Next use a suitable peening tool and carefully peen the head material around the entire edge of the insert. Standard exhaust valve seat inserts are not available for service. Oversize 0.015-in inserts only are available for service.

G.M. Fuel Pump With Opposed Seals

A new fuel pump assembly has recently been introduced as optional equipment in the production of certain G.M. Series "71" engine units.

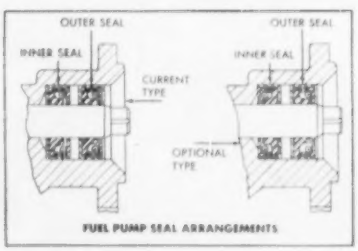
The optional type and the current type fuel pump assemblies are identical with the exception of the arrangement of the seals. The inner of the two seals in the new pump is installed with its lip facing toward the pump body—the other, with its lip facing in the opposite direction. The two seals in the current pump are installed with their lips facing away from the pump body.

The optional Fuel Pump Assembly, Part No. 5111366 (left-hand) with opposed seals, may be identified by a "star" steel-stamped on the ground face of the pump cover. The seal arrangement of the optional and current type fuel pumps are shown in the accompanying drawings.

The optional fuel pump assembly is being used on certain model 2-71 engine units due to the installation employing a fuel supply tank mounted at a level higher than the fuel pump on the engine. In these cases the inner seal serves to prevent seepage of fuel along the pump shaft and ultimately out of the vent holes in the pump body, especially when the engine is shut down.

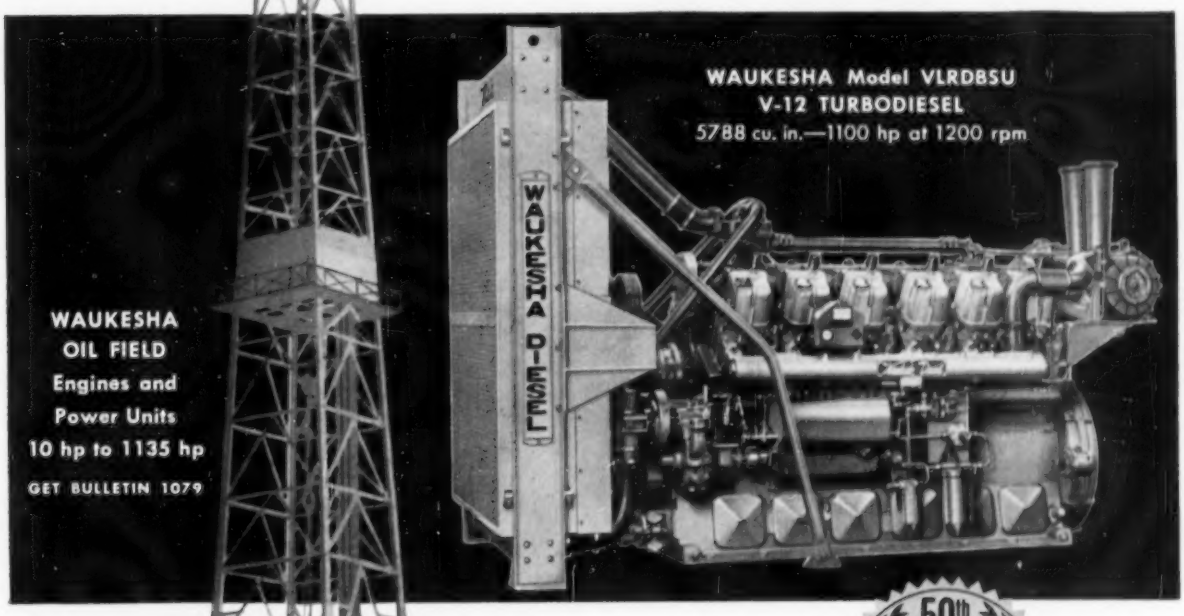
Occasionally, during engine operation, normal leakage may occur at the vent holes in the pump body. However, this leakage should not exceed a maximum of one drop per minute.

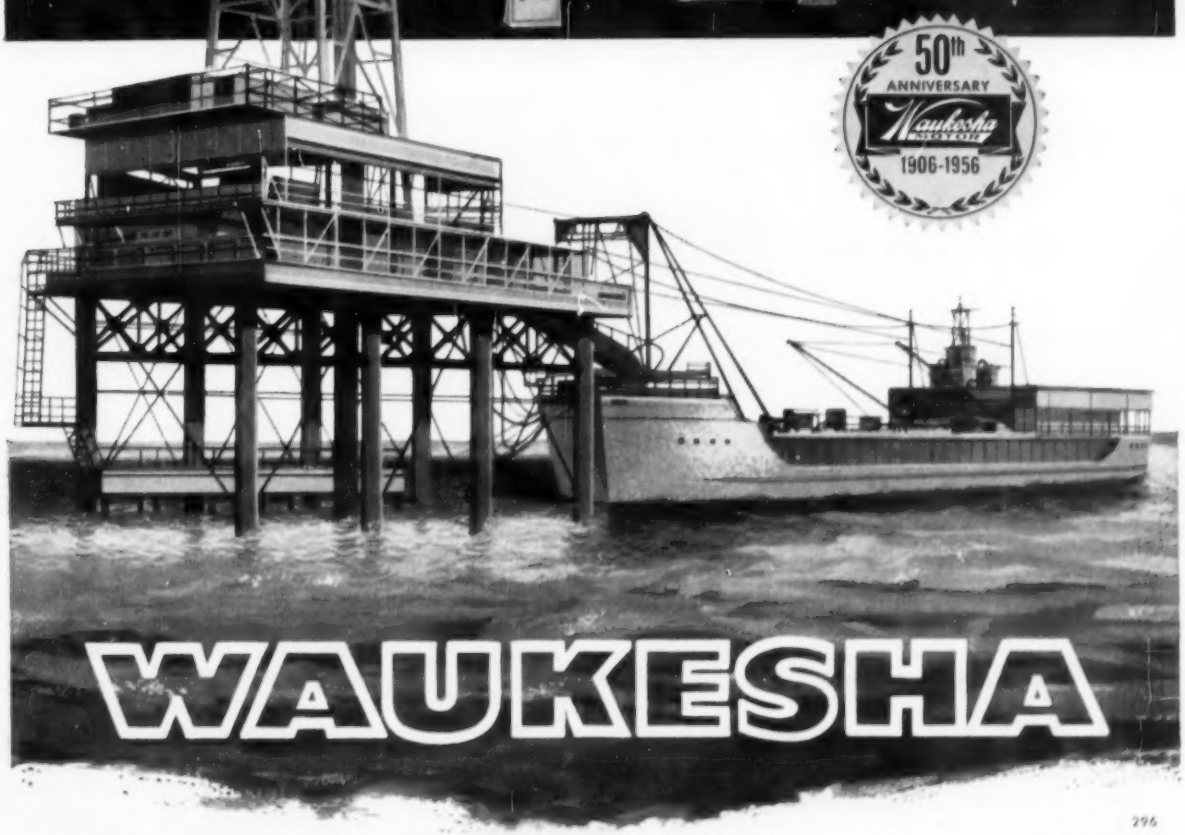
The optional pump assembly, which is available from the Service Parts Department, may be used on other applications which employ a fuel supply tank mounted higher than the engine. If the engine requires a right-hand fuel pump, the current right-hand pump may be reworked to the new seal arrangement. All that need be done is remove the two seals and install new seals opposing each other as illustrated in the drawing for the optional type pump.



FUEL PUMP SEAL ARRANGEMENTS

FOR off-shore DRILLING





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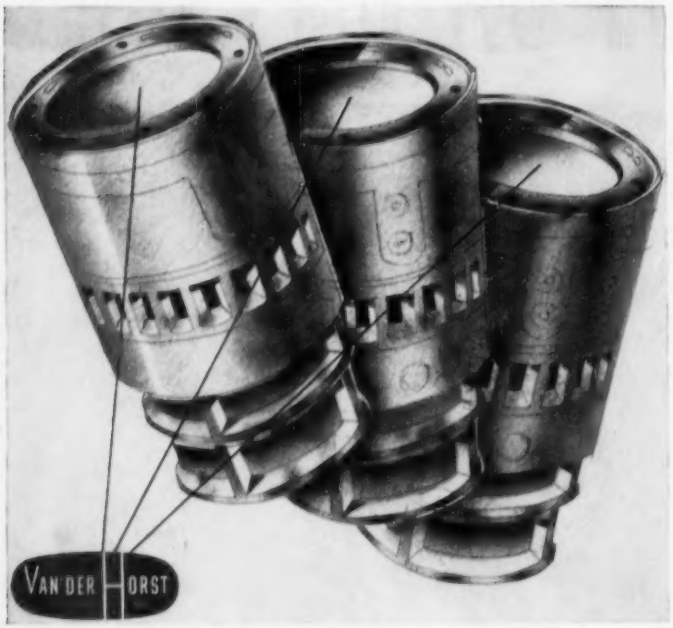

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news of our industry

Mobile Power in Canada

The British Columbia Power Commission announces that it has the first mobile trailer-mounted emergency generator units to be used by any public utility in western Canada. These are two custom-built outfits, of the multi-voltage type so that they may be used anywhere without additional transformers.

Engines are 12-cyl Mercedes-Benz turbocharged 8203B models, with switchgear and mobile dual trailers designed around them. Both units are operated at synchronized 1200-rpm speed. A Canadian General Electric 500-kw generator, direct-connected to each, supplies power at 2400, 4160, and 12,480 v, a variation that allows the units' use anywhere in the system.

Both units are equipped with an auxiliary Model 2BD-77 Buda, 2-cyl diesel, direct-connected to a 7.5-kw Onan 60-cycle, single-phase generator. In zero weather, they are used to preheat the main engines. They also provide station lighting and are used to charge all engine batteries.

Controls in the mobile units are automatic so that when the main engines are started they take on the station lighting while the auxiliaries are shut down. Fuel tanks are suspended beneath the trailers, holding enough for 24-hr service. Strip heaters are in the tanks to keep the fuel fluid in subzero weather. The main engines also have heating elements in the lube oil crankcase.

The first unit is seeing action at a small hydro-electric plant in the heart of the Canadian Rockies where temperatures this January were 25 below. The second unit is supplementing diesel installations in Merritt.

The movable power houses have been transported at up to 50 mph. Gross weight of each unit, with fuel tanks filled, is some 23 tons, not including truck. Each is housed in 35-ft long trailers so that they can be moved by truck, rail car, or ship. They are equipped with flood lights, fire-fighting gear, and all necessary tools.

news of our industry

Welding Research Laboratory Opened

Worthington Corp's. new Harrison, N. J. laboratory is one of the largest and most complete research facility of its kind in the country. The location will be used for welding application research, designing for welded construction and building of prototype models.

Aside from research, training programs to assist the corporation's divisions in training welders, supervisors and technicians will be instituted.

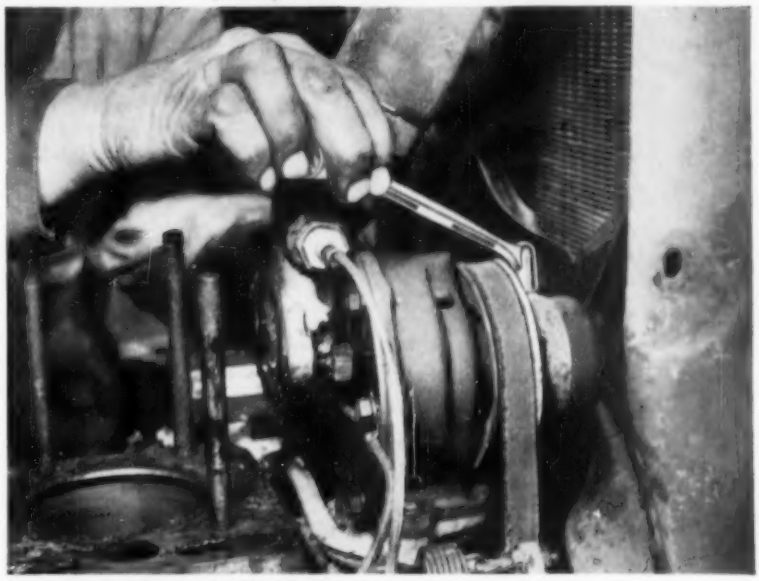
Cylinder Blocks Cast Without Sand Cores

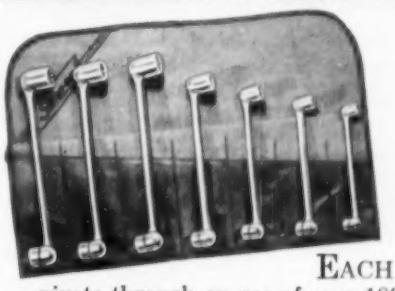
A new development by Perfect Circle Corp. promises to eliminate or drastically reduce the baked sand coring now used in engine block construction. All cylinders and top deck are a separate assembly. They are not cast with the block.

The centrifugally cast iron cylinders are silver brazed to a steel top block. The unit is sealed to the block by a paper neoprene gasket. The lower ends of the cylinders are sealed by rubber rings where they pass through the crankcase.

Although for the present this new design is intended for gasoline engines there is no apparent reason why it can't be adapted to diesel engine blocks. The advantages claimed for this new design are; cylinders are not subject to structural stresses; larger cylinder diameters are possible on given cylinder center distances; softer iron can be used in the block proper permitting about 25% more blocks to be machined; better material can be used in the cylinders; cylinder wall thickness is uniform and precisely controlled; engine block rejects are reduced; engines with a considerable range of bore sizes on the same basic block can be built; cylinder replacement is simplified; this design is adaptable to die cast aluminum blocks which have been under considerable research.

Snap-on* FLEX-HEAD WRENCHES — SLIP into tight spots — PIVOT for action





hand tools at their finest for the toughest jobs you have

FH-607-K
FLEX-HEAD SET

EACH socket of a *Snap-on* Flex-Head pivots through an arc of over 180 degrees — making it a handy wrench for reaching universal flange bolts, pan cap screws and similar jobs. The wrench swings over and under obstructions — handles hard-to-get-at nuts, studs, bolts. A friction spring holds the desired socket angle. With the handle in a vertical position, the nut can be spun rapidly. Flex the handle over and you have maximum leverage for tightening or breaking loose.

The *Snap-on* set illustrated provides all wrench sizes from 3/8 in. to 7/8 in., with the most widely used sizes duplicated on different handles.

Available from your *Snap-on* man or any *Snap-on* factory branch office. Write for general catalog "V" listing 4,000 *Snap-on* hand and bench tools.

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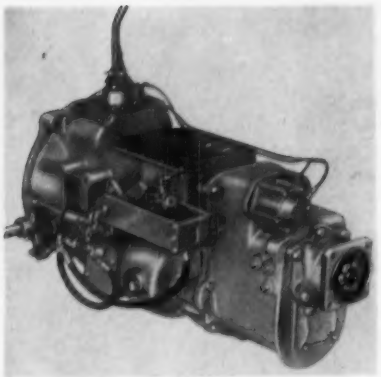
new products



Unishift Truck Transmission

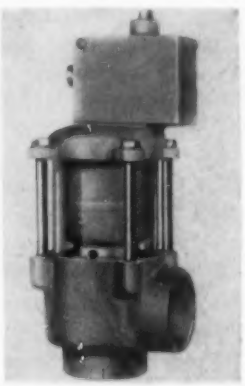
Mack Trucks' new Unishift is a unit 10-speed transmission with a single lever shift in which is combined a 5-speed main gearset and a 2-speed compound, with power-operated synchronized shifting of the 2-speed compound. It has a broad range of ratios with close steps properly integrated. It has a simplified control with only one lever and pre-selective shifting of the compound.

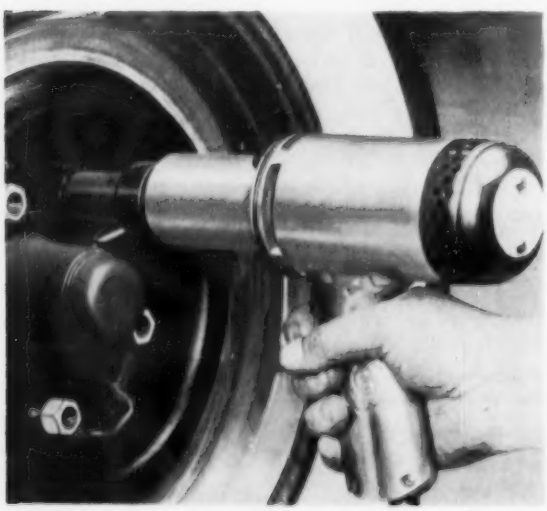
Other features include rapid, positive and quiet compound shifting through multiple disk-type synchronizers and compact construction. Having a single case it eliminates extra drive-shaft and universals. Each of the three sizes of Unishift has a direct drive in the main gearset either in fourth or fifth.

De Laval Emergency Breakover Switch

To safeguard against loss of oil resulting from possible improper centrifuge operation, De Laval developed a special fitting for installation in the water discharge line of the oil purifier. It is a float operated switch which permits easy observation of the normal water discharge but is mechanically actuated by excessive volumes of water or oil.

Excessive liquid flow opens an electrical circuit thereby sounding an alarm. The emergency breakover switch has multiple electrical terminals so that one or more electrical controls may be operated. After the cut-off switch has worked, the circuit must be closed by a reset push button which is located on top of the switch before further operation can be resumed. After the reset button has been pushed the purifier should be started in the usual manner.





Low Cost Electric Impact Wrench

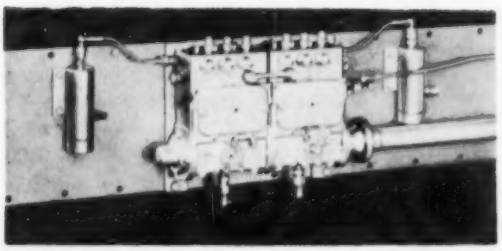
Introduction of the "pacesetter" by the Chicago Pneumatic Tool Co. now provides a new, inexpensive model to their line of air and electric impact wrenches.

This new addition features an attachable angle head that clamps on tightly. The tightness reduces power loss and eliminates excessive shank wear and dirt trapping. One handed use as a ratchet wrench is also possible. Accessories enable the tool to ream, tap, drill, drive screws, operate stud drivers, sleeve pullers and gear pullers.

With a slenderized nose, CP-724 can reach into awkward places. A one finger control allows reversing with one hand; but a safety reverse switch prevents reversing accidentally.

The wrench weighs but 7¼-lb with a 9⅝-in overall length, and the set includes the wrench, 15-ft of cord and a set of ½-in to 13/16-in sockets.

new products



New Diesel Engine Fuel Injector

Controlled and uniform fuel injection suitable for any type diesel engine is the claim of the Parker Diesel Engineering Co. for their new fuel injector. The result is more torque, increased horsepower and less part wear and engine downtime according to its manufacturer. Even better-than-new-performance is said to be possible when they are put on engines already in the field.

Each engine cylinder uses a pressure-control type valve and a fuel-pressurizing plunger. The plunger is cut with two helixes. During the intake stroke of the plunger a port admits fuel into the barrel under constant low pressure. The fuel is then put under high pressure, forces open a pressure-control valve and goes into a common pressure-balancing fuel receiver. Near the top of the plunger stroke the fuel, still under high pressure, reverses its direction of travel when the first helix provides a passage for measuring and delivering the fuel to the spray valve. The second helix spills the surplus fuel into the suction chamber.

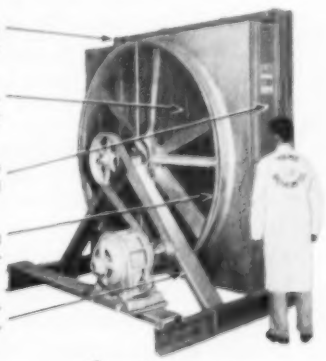
One pressure-balancing fuel receiver, serving one or more engine cylinders, assures uniform injection of fuel under predetermined pressure to all cylinders regardless of rpm. This tends to balance the firing in all cylinders eliminating uneven cylinder pressures and detonation. The engine is said to run quietly. Minute quantities of fuel can be accurately measured and delivered at a constant rate over long periods of time for smooth engine operation at slow speeds.

The plungers of the Parker fuel injector are actuated by an eccentric camshaft. It lowers stresses and controls each injection of fuel. This feature is said to give steadier firing resulting in greater torque, controlled pressures on the crankshaft, longer bearing and ring life and increased lube oil life. Horsepower is also said to be increased, acceleration is faster and fuel consumption is lowered. When engine load increases causing a drop in speed, torque remains high.

The injector is simple in operation and just as easy to mount on the crankcase panel of engines rated from 20 to 100 hp per cylinder. Each unit is made of uniform parts and covers a wide range of bore, stroke and rpm. Individual pump units for each cylinder are also available.

Five Straight REA Champions Served by Young Coolers

Five years in a row Young Radiator Company Cooling Units have contributed to the efficiency of champion REA plants! These winners were equipped with Young "MonoWeld"® Jacket Water Coolers (described below) and Young space-saving Aftercoolers. Wherever Diesel engine heat transfer such as this is involved, Young has the experience and the *proved performance record* to bring you a new high in engine efficiency . . . deliver more cooling . . . use less valuable horsepower to do it! That's just part of the Young story. Call or write for further details today.


Extremely rigid steel channels support core sections and plenum chamber mountings.
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Gas and lube oil cooling coils may be used between fan and liquid cooling core.
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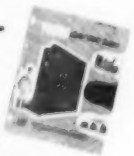

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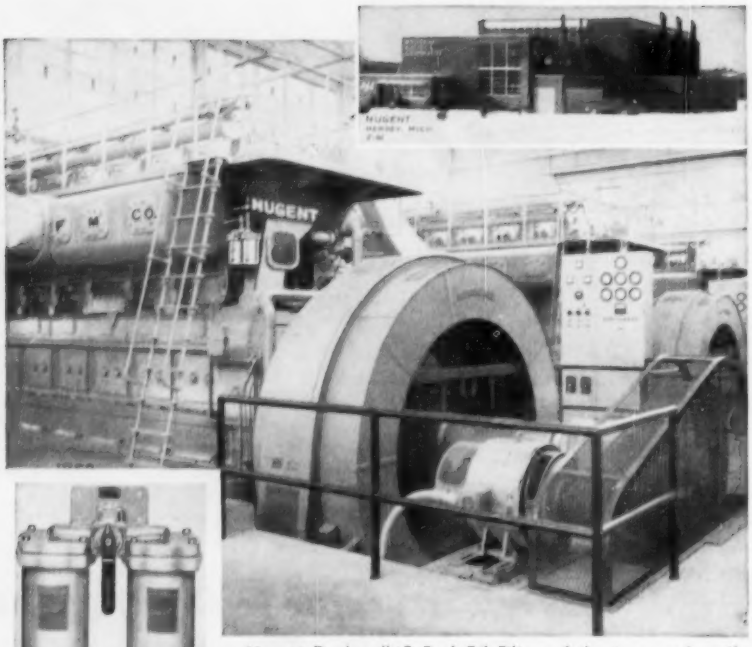

Nugent Duplex #1R Fuel Oil Filters of the type used on the Fairbanks-Morse engines at the Wolverine Electric Coop., at Hersey, Mich.

NUGENT Fuel Oil Filter User 3-Time Winner of R.E.A. Award

Our congratulations go to the management and staff of the Wolverine Electric Cooperative at Hersey, Mich., winner of the 1955 Diesel Progress Plaque for the most efficiently operated R.E.A. plant. Their capable efforts have been responsible for three such awards over the past four years.

Plant equipment includes three Fairbanks-Morse dual-fuel engines with fuel oil protection for each supplied by a Nugent Duplex #1R Filter. Vital pilot fuel oil is kept free of dirt and moisture by their filtering action. Foreign material that might clog injection units, cause excessive engine wear, or lead to faulty combustion is eliminated from the system by the use of these Nugent Filters.

Each unit of the Duplex #1R Filter functions independently or in parallel with the other, which allows cleaning to proceed with no operational interruptions. The filtering medium is a large area bag of closely woven, lintless, acid resisting material that is easily cleaned for reuse or is replaceable at low cost.

Nugent Filters are available in complete size ranges to satisfy your needs. Write for full data, outlining your filtering requirements.

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Wm. W. Nugent & Co., Inc.

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new products

Diesel Starting Aid

Turner Brass Works is marketing a diesel starting system which uses an ether-base blend of petroleum and which is claimed to insure quick, sustained, and reliable starting of cold engines. Uniform dependability of performance is said to be obtained by a metering arrangement that guarantees the same amount of starting fuel each delivery.

The system includes a pressurized tank holding the fuel, a control valve which meters the fuel, copper tubing, and a control cable. The tank bracket (including the meter valve) is mounted onto the firewall or other convenient part of the engine. The copper tubing furnishes the connection between the valve and the engine's intake manifold. The control cable leads through the firewall to the instrument panel of the engine. At this terminus is the control knob.

Action is instituted by pulling out the control knob and then pushing it back to place. When the knob is pulled, the metering chamber is loaded from the tank. When it is pushed back, it seals off the tank and allows the chamber's contents to be delivered to the engine's air intake manifold. Tank replacement is made by screwing a full tank into the valve body. A fuel tank holds about 100 single deliveries.

Hydraulic Pump Oiler

For heavy machinery parts oiling, Eagle Mfg. Co. is introducing a 2-qt oiler said to be capable of delivery of a full stream or just one drop of oil. It is a supplement to the company's smaller capacity line.

Available with either vertical, angle, or flexible spouts—all interchangeable—it also is all parts renewable. There are no soldered connections in the mechanism it is stated. Oil delivery depends on pressure exerted on a thumb lever which can be fitted with a controlled-measure attachment.

new products

Adjustable Wrench

Described as a revolutionary new tool is the Handi-Spin, a ratcheting adjustable wrench without any ratcheting device. It is capable of remaining on a hex head nut all the time while tightening or loosening the nut.

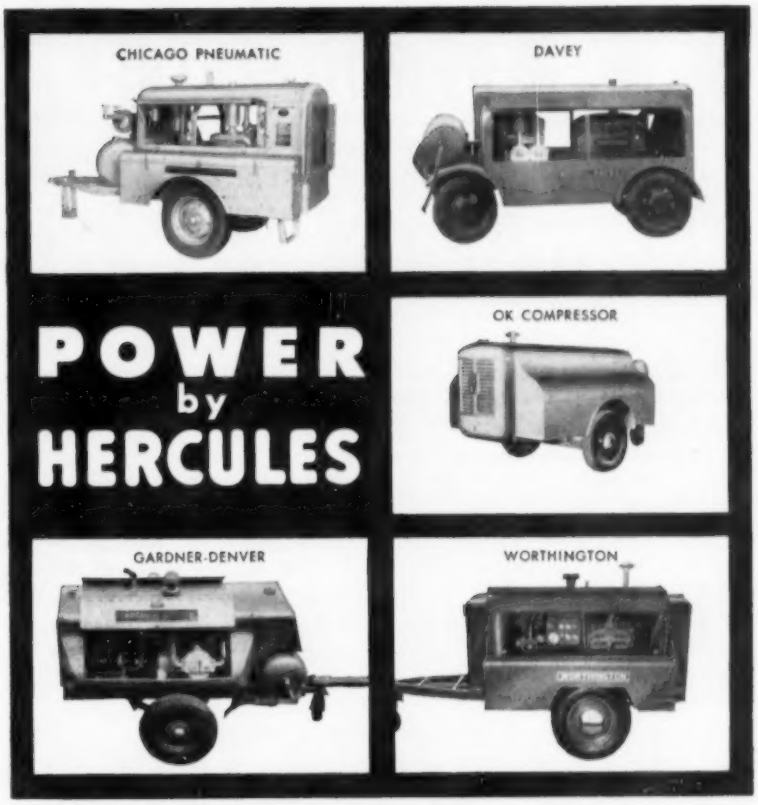
The secret of the tool, a production of Tedd Co., lies in its upper jaw which allows for a secure bite on the nut yet releases the bite when pushed upward. The wrench works up and down, slipping on the way up and pulling on the way down for a constant pumping action. This is accomplished by the back part of the jaws. When the forward part of the jaws are used, the wrench works without slipping, as a regular wrench.

Boost Diesel Piston Life 500%

That's the claim Line Air Products Co. makes for its Heliarc welding process. It states that years of service are being added to the life of 9-in oil-cooled aluminum pistons used in the engines of the Reading Co.'s diesel locomotives. Increase is made by machining away the worn carrier at the top of each piston and then Heliarc-welding a new aluminum carrier in its place.

Total shop costs of labor and material in the repair operation are said to be $29.93, where a new piston would cost $97.55. And using the same welding process, it is further claimed, a piston can be rebuilt as many as five times, saving over $300 that would otherwise be spent on new pistons. This operation is stated to have increased mileage of some pistons to 2½ million miles before they had to be replaced.

A new carrier is fusion-welded to the piston in a matter of 6 or less min. When the weld is completed, the face is machined down for a smooth surface, and the piston is ready for service. More information on the process is available for the asking from the company.



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HERCULES ENGINES are popular...
but let's talk performance.

Popularity isn't the only reason Hercules Engines power these well-known makes of air compressors. The main reason these companies select Hercules Engines is that they provide dependable power—engineered to the requirements of the compressor.

Air compressors, like other types of equipment, are designed by the manufacturer for specific capacities. They need an engine that will produce the rated power as well as a power plant to fit the operating features of the application.

Then too, owners appreciate the dependable service and "trouble-free" operation of Hercules Engines. They know that with routine maintenance, their Hercules powered equipment will give them years of "top-notch" performance.

With the addition of the recently announced G.O. Series (Gasoline Overhead Valve) and the D.D. Series (Direct Injection Diesel), Hercules customers have an even greater selection of internal combustion engines and power units. More than 90 different models are available from 3 to 500 H.P. for operation on natural gas, gasoline or diesel fuel.

Hercules Sales-engineers will be glad to assist you in solving your particular power problems. Drop us a letter, we'd be most happy to work with you—of course, there's no obligation.

All Types of Dependable Power

Gasoline Diesel

HERCULES MOTORS CORPORATION, Canton, Ohio

new literature

Ni-Resist Austenitic Iron Inserts
for piston ring grooves are featured in The International Nickel Co. Inc., pamphlet "Keep Them Rolling". More mileage, longer service and less maintenance for aluminum pistons in diesel engines is the theme. The booklet explains in detail why pistons fail, when top ring grooves give out, what ring groove inserts are and what they do for pistons. Case histories are also given on aluminum pistons with Ni-Resist inserts.

Air Control Valves
and accessories in 17 different lines are detailed in a quick reference guide published by Airmatic Valve, Inc.

For Metal-Working People
interested in the relatively new process of powder metallurgy, Harper Electric Furnace Corp. has prepared a bibliography of periodical references to the subject. It refers to nearly 250 articles printed in more than 50 English-language publications in the past two years.

Air and Gas Compressors
for all pressures from deep vacuum up to 35,000 psi, with capacities up to 165,000 cfm, are pictured in operation in a new bulletin from Ingersoll-Rand Co. Fifteen basic types of compressors built by the company are illustrated.

Diesel Standby Power
Bulletin No. 125 is a new offering by the Murphy Diesel Co. It covers application of their generator sets, both diesel and dual-fuel engines. Information is given on design features and it pictures how standby power not only saves money, as in continuous power for industrial production through power failure; but also saves lives in emergencies at hospitals and airports.

"Visual Alarm Systems"
is the title of a catalog recently published by the Autocall Co. It covers various types of annunciators, relays and visual and audible alarms.

Here's Why
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WITH Bendix
STARTER DRIVES

CHECK and COMPARE THESE FEATURES
• Starting motor can be mounted more easily and in more positions.
• Requires no actuating linkage—solenoid can be placed in any convenient position.
• Simple in design—has fewer parts—needs fewer adjustments.

It takes a truly outstanding product to receive over 100,000,000 endorsements. Yet, that's the number of Bendix Drives that have been installed. No other starter drive approaches this record of outstanding performance. That is why, whatever your type of diesel or whatever its purpose, it will pay you to specify Bendix* Starter Drive for the most economical installation and dependable performance. *REG. U.S. PAT. OFF.

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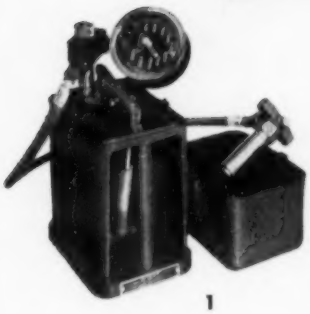
KIENE® diesel engine test equipment



1. Model KTP-50, Hydraulic Test Pump . . . designed for field service . . . portable . . . no bolts or clamps for leverage . . . many novel features.
2. Model K-120, Universal Indicator . . . for high-speed automotive type diesels . . . can be adapted to larger engines for firing pressure readings.
3. Model V-10, Indicator Valve . . . rugged . . . will not blow open . . . adaptions for all locomotives.
4. Model K-100, Cylinder Pressure Indicator . . . simple . . . accurate . . . for compression and firing pressures on large horsepower engines.
5. Model UTS-10, Portable, Universal Unit Injector Test Stand . . . checks all sizes in one fixture.

Kiene Diesel Engine Test Instruments are recognized throughout the industry for their accuracy and adaptability. They are designed for long service under most severe field conditions. Kiene equipment assures the proper maintenance of diesel engines . . . helps prevent costly down time. Get the facts on Kiene before you invest in diesel test equipment.

Send for Descriptive Literature

Kiene Adapters and Connectors available for all makes and models of diesel engines manufactured in U.S.A.

KIENE DIESEL ACCESSORIES, INC.
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new literature

Inverted-Y Electrification
Which is now available for the first time on all makes of cranes and runways is described and illustrated in Catalog No. 2021-A offered by the Cleveland Crane & Engineering Co.

Custom-Made Rubber Parts
and components are featured in a file folder brochure depicting the facilities of Goshen Rubber Co., Inc. The reader is given a tour of the engineering procedures in developing and producing specialized parts.

Engine-Driven Welders
for industrial arc welding use are given coverage in the latest literature from Lincoln Electric Co. Complete specifications and typical installation shots are contained.

"Engineered Kilowatts"
booklet by International Fermont Machinery Co. embodys a new concept in the field of kilowatt-producing machines. It discusses internal combustion generating units ranging from 5-KW to 250-KW, automatic or manual starting.

Fermont bulletin #955 incorporates material valuable to architects, engineers and contractors and others in the field. Among the data discussed is selection factors, typical specifications and information on installation and automatic starting controls.

Portable Power Tools
for manufacturing, construction, and automotive use are listed in the 1956 catalog of Skil Corp. More than 100 models and accessories are detailed, ranging from radial saws to valve seat grinders.

Induced Draft Cooling Tower
construction and operational details are in a special bulletin from Foster Wheeler Corp. Information about this latest development of the company is supplemented with perspective drawings of major equipment features.

A Guide to Instrumentation
literature has been issued by the National Bureau of Standards, prepared as part of a research and development program sponsored by various federal agencies. It lists over 1200 references.

Light Load Area Substations
standardized and packaged, are described by Allis-Chalmers in a bulletin listing materials furnished for high and low voltage structures. Diagrammed optional arrangements for each are featured.

organizational news

E. D. Tull

President Elect of ICEI

E. D. Tull, executive vice president of the Cummins Engine Company, Inc., has been elected president of the Internal Combustion Engine Institute. He succeeds B. G. Van Zee, chief engineer of the Minneapolis Moline Company, who continues as a member of the board of directors.

Merger of Filter Corporation

Commercial Filters Corp. of Melrose, Mass. has announced the merger of Honan-Crane and Michiana to form a new subsidiary, Indiana Commercial Filters Corp. This action follows the Mass. firm's recent purchase of Houdaille-Hershey of Indiana, Inc. (makers of Honan-Crane filters) and the Filter Division of Michiana Products Corp.

Named Regional Manager

of Alco Products, Inc., western area, is Joseph W. S. Davis. He succeeds Charles F. Venrick, who has resigned. Mr. Davis will make his headquarters in Chicago.

E. J. Koberna

In a New Post

at Minneapolis-Moline Co. is Edward J. Koberna, named assistant to Henry S. Reddig, senior vice president of the firm. He was lastly associated with White Motor Co., until last October when he engaged in studies of MM operations in preparation for his present post.

DESIGNED for DIESEL . . .

- AMMETERS — Hermetically sealed magnetically shielded, dependable
- TEMPERATURE GAUGES— Remote indicating vapor pressure or direct metallic
- OIL PRESSURE GAUGES— Super sensitive, with full overload protection

Whenever you are selecting the gauges for your new models, look to the Rochester Manufacturing Company for the latest in design and dependability . . . for the best rugged service.

Call on your Rochester Sales Engineer today. He's a specialist, ready and well qualified to serve as your technical advisor on engine gauges. Write, wire or call.

SERIES 2900

New ROCHESTER ENGINEERED PRESSURE SWITCH

Here's a switch that's designed for heavy duty application, close "on" or "off" differentials. Consistently holds precise cut-in, cut-out settings. Available in single and double terminal models. ¼" or ⅛" thread pipe fitting.

Rochester

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ROCHESTER GAUGES — DEPENDABLE ACCURACY

DIAL THERMOMETERS GAUGES AMMETERS

Clayborne Manufacturing Company
429 NORTH MAIN ST. • MONTICELLO, INDIANA

6-110 GMC Diesel as shown. Note Entire Overhaul Is Accomplished without Use of Platform.

- Engine Overhaul Stands
- Engine Dollies
- Dynamometers

Model 900 Diesel Engine Stand

Accomodates:
CATERPILLAR
CUMMINS
GENERAL MOTORS
INTERNATIONAL HARVESTER
WHITE

PURCHASE THROUGH YOUR JOBBER

organizational news

C. H. Kimmel

New General Manager at Morco

C. H. Kimmel, president of The Ohio Crankshaft Company, has announced the appointment of David F. Clark as General Manager of Ohio's subsidiary Morco, Incorporated.

Morco, in Bedford, Ohio, is engaged in reconditioning diesel engine crankshafts. The company is pioneering an exchange program which enables a diesel engine user to exchange a worn shaft for a reconditioned unit through a coast-to-coast set-up of diesel engine dealers.

W. H. Mouquin

C. C. Bray

Continuing Expansion

of customer sales and service facilities at De Laval Steam Turbine Co. has resulted in two appointments to the company's new Chicago headquarters. W. H. Mouquin has been placed as district manager and C. C. Bray as regional sales supervisor.

Appointed Distributors

for International Fermont Machinery Co., Inc. is Morhan Exporting Corp. Except for the U. S. and Canada, the distributorship of the air-cooled electric plants is on a world-wide basis.

W. M. Steed

Southwest Regional Manager

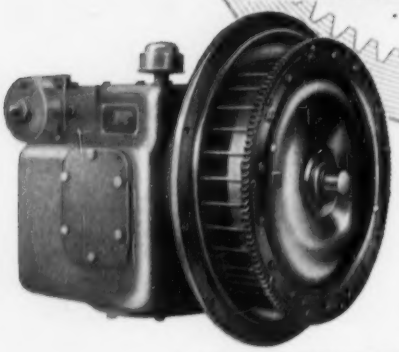
is the new title of W. M. Steed at Cummins Engine Co., Inc. With head office in Los Angeles, his territory will consist of California, Arizona, and Nevada.

Industrial Waste Treatment

management are the new duties of Charles Bueltman at Permutit Co. His new post is in line with the company's plans for expansion of its activities in this field.

New PLAN-GEAR PGT TRANSMISSION

• PATENT PENDING •



the Transmission that's as simple to operate as an Electric Motor

• AMERICAN GEAR'S new **PGT** is a hydraulically operated, compound planetary transmission that provides a simple, versatile and extremely flexible means of power transmission.

• **PGT's** outstanding performance has been verified by complete tests in the laboratories of one of the country's leading Institutes of Technology.* It has been successfully used on earth movers, tractors, road rollers and similar equipment. Sturdily built, conservatively rated, **PGT** offers important advantages over more complex transmissions, including:

- Easily operated by anyone by merely moving a single hydraulic control lever
- Practically instantaneous (1.5 seconds) change of speed or direction without shifting gears
- Only one control valve lever for all speeds and neutral
- Utterly smooth...no shock...no jerk... no noise
- Cushion shift prevents shock loading, eliminates trouble
- Eliminates operator fatigue by eliminating clutch pedal
- Hydraulic control lever placed convenient to operator without regard to location of transmission
- Planetary gearing means considerably less length for comparable loads and speeds
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- Two power take-off apertures can transmit up to one-third of engine output maximum

*Complete report on request

Write today for this new 8-page booklet which gives complete information, design details on all 7 models of **PGT** *transmissions*

• 7 DIFFERENT MODELS • 85 OR 150 TO 200 LB. FT. TORQUE
1 OR 2 SPEEDS FORWARD • CHOICE OF REVERSE RATIOS

USE PGT TRANSMISSION ON

• Lift trucks • Earth movers • Hoists and cranes • Car pullers • Slushers
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news of our industry

Record Diesel Truck Sales

More diesel-powered trucks were sold last year than ever before in history. This statement was released by Mack Trucks, Inc. who revealed that a full 70% increase was achieved above the previous year. This 1955 total was 7% over that of 1951, the former record sales year.

In this category of truck sales, Mack further announced that it led all manufacturers, taking 42% of the total market, and adding an 11% gain to its 1954 lead in the field. The constantly improving efficiency of the diesel truck engine is creating this growing trend in sales, E. G. Ewell, Mack vice president, declared.

He said operators of both long-haul trucks as well as the larger size short-haul vehicles used in construction and logging are finding diesels more durable and economical. However, he warned that a tendency to pile heavier taxes on diesel fuel than on gasoline could discourage further development of diesels for highway use.

ATA Council Meeting in Chicago

A four-day meeting is scheduled for the Equipment and Maintenance Council of American Trucking Assns, beginning May 15. "Cutting Costs and Getting the Most from the Maintenance Dollar" will be the central theme.

Following previous patterns, Tuesday, the lead-off day, will include technical reports on new developments. Wednesday will be occupied in discussion of the truck brake problem, regarding the ICC's proposed brake regulation. A panel "The Manufacturer Meets the Maintenance Man" is offered Friday, as well as presentation of awards. "Maintenance of the Power Train . . . " presented by experienced technicians, followed by the election of officers will wind up the meeting on Friday.

Original plans for an equipment exhibition in conjunction with the council meeting were cancelled for lack of exhibit facilities.

news of our industry

Fiat Turbocharges 2-Cycle

Fiat of Italy, having completed two years of experimental testing in their private power station, is now converting existing engines to turbocharged operation plus building new models. They recently converted an existing Type 688, 8-cyl, single-acting 2-cycle engine for the MOTORSHIP SESTIERE. Others are anticipated.

The turbocharging system consists of two Brown Boveri turbos in series with a crosshead-driven reciprocating blower. Air is cooled after the turbos and again after the mechanical blower. Thus, adequate air is insured for all maneuvering conditions.

With a 750°F exhaust as the limiting factor, maximum bmep at overload carried by the non-turbocharged unit was 85 psi. Turbocharged, the unit produced 135 bmep. Using 575°F as a limit for continuous operation, power increases of 25% to 30% are shown.

Both tests and actual operation are on bunker fuels, something on which Fiat has had long experience. Fuel curves are reported to be quite flat and in the bmep range from 85 to 100 psi is said not to exceed 0.355 lb per bhp hr.

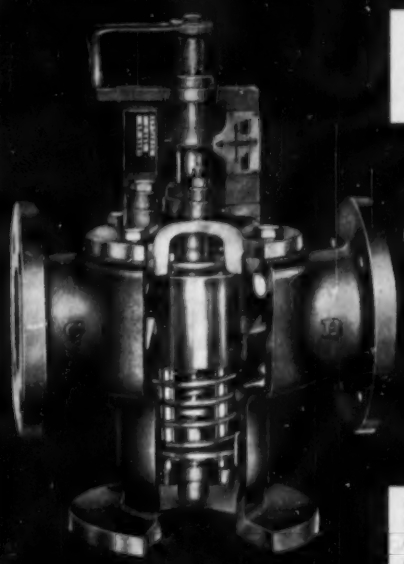
Prize Contest Announced

A total of $1000 in cash prizes will be awarded to 31 engineers and designers for the best new applications of thin gauge and/or high-precision tolerance stainless steel strip. Entry blanks may be obtained from Prize Awards Comm., American Silver Co., Flushing 54, N. Y. Contest closes midnight, May 30.

New uses are being sought by the company for strip that can be rolled down to hitherto unobtainable thicknesses as low as 0.0005 in. or to any thickness with tolerances as close as plus or minus 0.0001 in. Widths in both categories range from 1/16 in to 7 in. Awards will be made on the basis of originality and practicality. Winners will be advised by mail no later than June 30.

ALL-IN-ONE CONTROL FOR HIGHER ENGINE EFFICIENCY

By controlling cooling water or lubricating oil temperature, this Sylphon Engine Control guarantees the engine temperature you need for maximum operating efficiency—minimum fuel consumption. And best of all, it detects temperature changes and adjusts valve openings as *one complete unit—from one location.*



POWER-PILL* fusion-type thermal element provides powerful response to temperature changes only. Not affected by pressure.

Tamper-proof . . . factory set for any specified operating temperature between 120° and 190°F.

Entire operating mechanism lifts completely out of the valve body. No breaking of pipe connections if servicing is ever required.

Protected against damage in case of temperature over-run. Simple, rugged construction minimizes servicing and maintenance.

SYLPHON ENGINE CONTROL
No. 1280 shown here has manual operator, No. 1281 does not. Manual operator over-rides thermal element and permits valve to be opened or closed at any time.

Valve body and other parts are corrosion-resistant. Valve sizes 2" through 6", pressures to 150 psig.

*TRADEMARK

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CONTROLS COMPANY

FULTON SYLPHON DIVISION • Knoxville 1, Tennessee

news of our industry

Proved Reserves Hit New High

Despite record-breaking production and consumption, proved reserves of liquid petroleum and natural gas went up another notch in 1955, the American Petroleum Institute and the American Gas Assn. have announced in a joint annual report.

Proved reserves refer to those underground supplies of liquid petroleum and natural gas whose locations have been established and estimated, and which are known to be available for production. Not taken into consideration are the millions of acres of U. S. lands known to be favorable to the accumulation of oil and gas but whose potential has not yet been developed or established.

The joint report states that reserves of liquid petroleum rose to 35 billion 400 million bbl in 1955—a 1-yr increase of 645 million bbl. Natural gas shot up to 223 trillion 697 billion cu ft, for a net addition of 11 trillion 986 billion cu ft, the greatest 1-yr increase since 1946.

It was emphasized however, that though the net results are on the favorable side, they serve to point up oilmen statements that the search for oil is becoming more difficult and more expensive with each passing year. It was noted that the industry drilled more than 56,000 wells in 1955 (a record number in itself), yet the net increase in proved reserves are only moderate and far from the immediate post-war years when they exceeded a billion or more barrels on at least six occasions.

Production of both oil and gas hit all-time peaks last year. Liquid petroleum production was estimated at 2 billion 739 million bbl, up 181 million bbl over 1954 and up 125 million bbl over the previous record set in 1953. Production of natural gas was estimated at 10 trillion 118 billion cu ft, an increase of 691 billion cu ft over 1954.

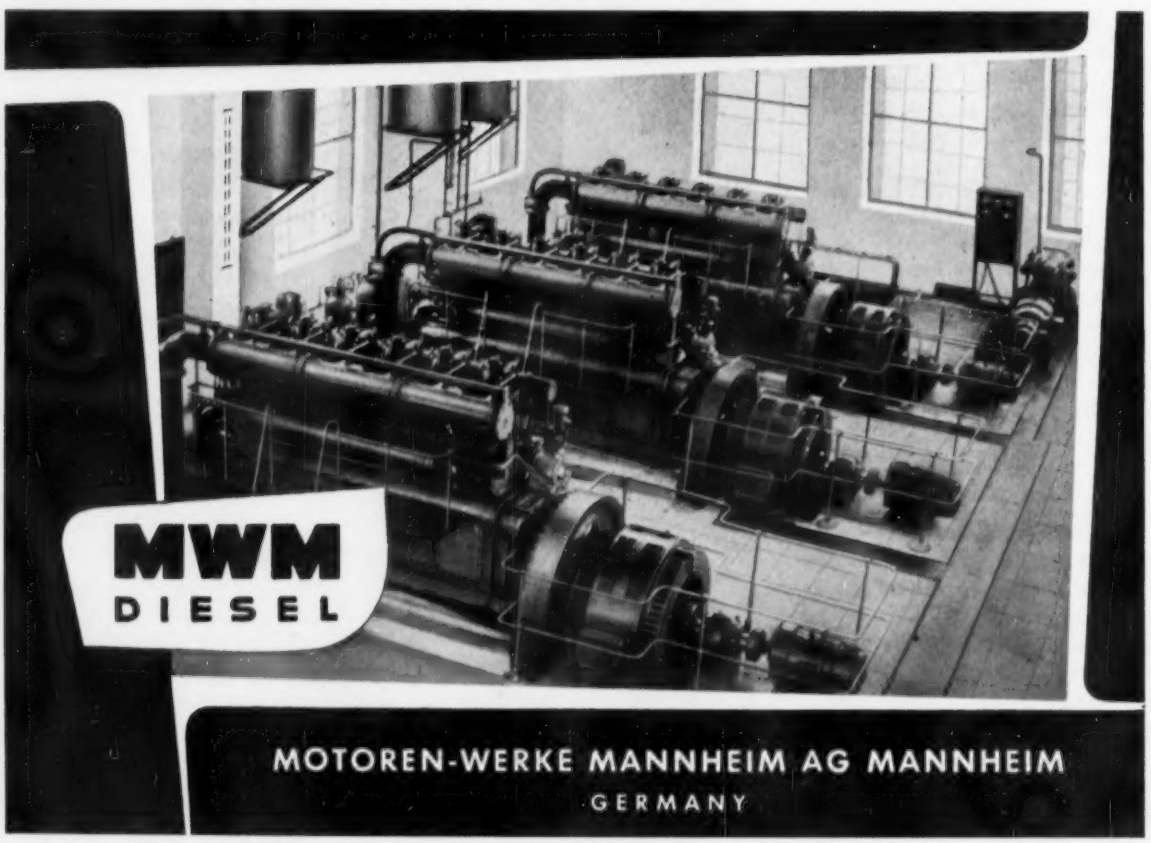
Liquid petroleum, according to the API, consists of crude oil and natural gas liquids. Crude oil proved reserves went up to 30 billion bbl in 1955, an increase of 451 million bbl. Natural gas liquids rose to 5 billion 438 million bbl in proved reserves, a 194-million bbl increase.

Merchants Motor Buys Diesels

Twenty new Kenworth CBE tandem tractors powered by Cummins NHB 200-hp diesels have been ordered by Merchants Motor Freight Inc.

In making the announcement, S. Wasie, president of the trucking firm, stated that the new models will constitute the backbone of his company's run between Denver, Omaha, Chicago, Toledo, Detroit, and Cleveland. Delivery of the new equipment will be taken in Denver.

A driver training program has been established to acquaint more than 40 drivers, who will operate the long haul equipment, with the trucks. Classes are scheduled for Denver, Omaha, and Chicago.



THE BEST KNOWN GUIDE TO

Diesel Design . . .
Maintenance . . .
Operating Data

THE DIESEL ENGINEERING HANDBOOK

Now in its brand *new*, 835 page, 9th Edition, the DIESEL ENGINEERING HANDBOOK is read by 55,000 top men in all industries building, servicing, or operating Diesels—Construction . . . Trucking . . . Stationary Installations . . . Marine Use . . . Railroading.

More than 900 separate Diesel topics are reviewed. Its 30 chapters analyze such vital Diesel subjects as:

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- *Cooling Systems*
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- *Supercharging*
- *Starting Systems*
- *Engine Air Systems*
- *Speed Governors*
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- *Dual-Fuel Engines*
- *Diesel Engine Specifications*

—12,000 *Facts On* 1100 *Diesel Makes & Models*

Here's what the Automotive Engine Rebuilders Association Bulletin has to say of the DIESEL ENGINEERING HANDBOOK:

"The most complete and best known Diesel reference book . . . just the thing for the Diesel man, whether a beginner or veteran, who wants to have at hand, when he needs it, vital information and data."

Order *now*, and put it to work for YOU. You'll want to consult it every day—to keep abreast of the most efficient maintenance procedures . . . to know the construction details of every Diesel . . . to insure reduced equipment "down-time".

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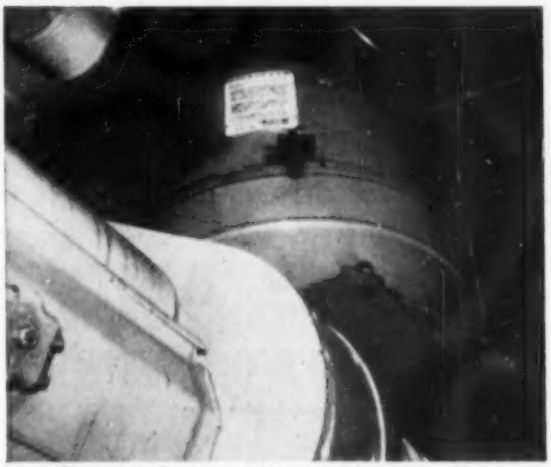
HB 3/6

TOP CYLINDER LINER WEAR ONLY .0075 AFTER 796,000 MILES WITH AIR-MAZE OIL BATH AIR FILTER



Photograph shows type of engine and filter assembly used by this railroad to cut ring and cylinder liner wear.

LOOKING for a way to lick excessive ring wear on its diesels, a leading midwestern railroad* equipped one of its road passenger units with an Air-Maze oil bath air filter. 796,000 miles later, inspection of one of the original power assemblies revealed that top (not average) cylinder liner wear was only .0075 inch. The ferrox indicating grooves were visible over the entire periphery of every compression ring. And analysis of air box deposits revealed only .20% silica content as compared with the usual 5-10%.

Result: The railroad was able to extend power assembly component life to well past the former maintenance schedule.

Air-Maze oil bath air filters not only do a better filtering job, they also reduce filter maintenance. Up to 3 months without servicing—up to 24 times as long as panel-type filters! And because they save on both engine *and* filter maintenance, they pay for themselves in less than a year.

Air-Maze oil bath filters clean air thoroughly because they scrub air in a bath of oil. And an oil-washed screen traps any remaining dust, passing only clean, oil-free air. For further information, call on us. The Air-Maze Corporation, 25000 Miles Avenue, Cleveland 28, Ohio.

*Name on request. Please write on your business letterhead.

AIR-MAZE OIL BATH FILTER MODELS AVAILABLE FOR THESE LOCOMOTIVES

MFR.	HP	SERVICE	MFR.	HP	SERVICE
Electromotive	800-900	Switcher	Alco-GE	2250	Rd. Switch
Electromotive	600	Switcher	Alco-GE	2250	Rd. Pass.
Electromotive	1000	Switcher	GE-Cooper Bess.	600	Switcher
Electromotive	1200	Switcher	B-L-H	800	Switcher
Electromotive	2000	Rd. Pass.	B-L-H	1000	Switcher
Electromotive	2250-2400	Rd. Pass.	B-L-H	1200	Switcher
Electromotive	1350	Rd. Freight	B-L-H	1500-1600	Rd. Switch
Electromotive	1500-1750	Rd. Freight	B-L-H	1500-1600	Rd. Freight
Electromotive	1500-1750	Rd. Switch	F-M	1000-1200	Switcher
Alco-GE	900	Switcher	F-M	1500-1600	Rd. Switch
Alco-GE	1000	Switcher	F-M	2000	Transfer
Alco-GE	1500-1600	Rd. Switch	F-M	2400	Trainmaster
Alco-GE	1500-1600	Rd. Freight			

AIR-MAZE The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS

news of our industry

Fire-Fighting School

Fourteen different fire training courses, each lasting three days, will be conducted this year on the 10-acre fire test field of Ansul Chemical Co. The school, now in existence for 10 years, is believed to be the only one of its kind in the country.

Students will be taught to use hand, wheeled, and large stationary fire equipment against flammable liquid and propane gas fires of all sizes and types so that they may train others in their home plants. Group discussions, film showings, and a plant tour are also part of the curriculum.

There is no tuition fee and registration on a first-come basis will be limited to 25 men for each class. Dates for the school begin May 21 and end October 10.

Diesel Buses for New York City

In a major modernization of its surface transportation facilities, New York City's Transit Authority has placed an order for 318 diesel buses with Mack Trucks, Inc. The last previous bus purchase by the city was in 1950 when it bought 440 Macks. Under the terms of the new contract, 18 buses are to be delivered within four months of the order's placement, with 75 buses each month therafter.

The new buses are to be standard models featuring clear-opening doors of 45-in width, extra-wide aisles, panoramic windows, and full ventilation. Powered by Mack's Thermodyne diesels, the buses will also feature hydraulic torque converters and airglide suspension.

In the order of distribution, 44 of the buses will replace 40 trolley cars on two routes in Brooklyn. A fleet of 175 vehicles will be replaced by 158 of the new buses, which have larger seating capacities. The final 116 will replace 116 gasoline buses now in operation on Staten Island.

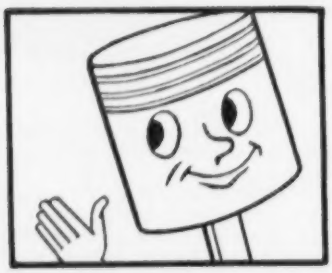
New Haven Orders 140 Diesels

The New York, New Haven & Hartford Railroad announces that it has finalized commitments for $20 million to pay for 140 new diesel locomotives. Announcing the equipment purchases, George Alpert, new president, declared that the railroad's lack of motive power was its most pressing problem. The current fleet of 360 diesels will not have its load lightened, however, until June of this year.

The rail carrier has already taken delivery of five units ordered in July. These are 1200-hp models built by Electro-Motive, which expects to send 15 more this month. Two 1800-hp units are expected in April from Alco, Inc., with 12 more of the same in May. Fairbanks, Morse & Co. will deliver six 1600-hp locomotives in May. The road also expects 25 additional units from the three named builders in June and another 15 in July.

The remaining 60 of the order will be 1750-hp units designed by General Motors especially for the New Haven. They will be equipped for conversion to third-rail operation and will not be completed until some time in 1957.

STARTS AND STOPS
. . . sure and safe



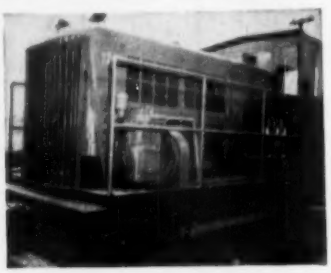
By Cecil Diesel
ROVING REPORTER

KANKAKEE, ILL.—A power shovel dumps the final load of rumbling stone into the last car. The train is loaded. A shout from the rear, then the International UD-1091 diesel

hums louder. The locomotive eases the train to a roll . . . hauls the heavy load of stone on a quick trip from quarry to crusher . . . brakes to a steady, sure stop.

I ask the engineer, "How'd you start and stop so smooth with that heavy load?"

"Easy," he says. "Compressed air operates sander and brakes — and this air is furnished by a QUINCY Compressor." Lehigh Stone Company has found it can rely on its

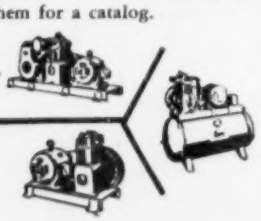


Model 340 Quincy Compressor . . . for a supply of air that's always there.

And there's a Quincy Compressor to fit every diesel requirement — including horn blowing and engine starting. Let Quincy help you select the right model from a range of mountings and sizes — from 1 to 90 CFM. Write them for a catalog.

Quincy COMPRESSORS

QUINCY COMPRESSOR CO.
DEPT. J-48, QUINCY, ILLINOIS



World's finest air compressors

news of our industry

Mirrlees Extend Engine Range

Brush Aboe, Inc., N. Y., a subsidiary of the Brush Group of England, have announced an addition to their Group's range of diesel engines. Mirrlees, Bickerton & Day Limited, their factory in Stockport, have introduced a 16 cylinder engine which will be available naturally aspirated, pressure-charged, and pressure-charged with air coolers.

The KV16, is a natural development from their KV12. There is, therefore, a high degree of interchangeability of parts. Such items as cylinder heads, cylinder liners, pistons, bearings, connecting rods, valves, and fuel injection equipment are common to both the 12 and 16 cylinder models.

The cylinder bore, piston stroke, piston speed, bmep, compression pressure, maximum pressure, compression ratio, mechanical efficiency, thermal efficiency, specific fuel and lubricating oil consumptions, and the bearing sizes and pressures are the same in both the KV12 and KV16.

The KV16 is designed to run at speeds between 200 and 428 rpm. In its pressure-charged form with air coolers (KVSS16), it will develop 4128 bhp at 428 rpm under n.t.p. conditions.

Design Engineering Conference

Outstanding authorities in various aspects of design engineering will lead four days of discussions in this field at Convention Hall, Philadelphia, May 14-17. The conference, sponsored by the machine design division of the ASME, will be held in conjunction with the Design Engineering Show, a new industrial exposition produced by Clapp & Poliak, Inc.

Topics for the conference sessions include cost reduction in product design, procurement and training of design engineers, engineering materials for products, miniaturization, recognition for invention, and legal rights to inventions.

Exhibits will demonstrate components, materials, finishes, shapes, forms, and services used by design engineers for manufacture of end products for consumer and industrial use.

RR Journal Box Development

Hyatt Bearings Div. of General Motors has announced completion of exhaustive tests on a low-cost roller bearing journal box for freight cars "that will permit freight trains to step up operating schedules and cut lubricating stops for cars to about once every three years."

The new Hy-Load is said to be so simplified and economical that large-scale conversion to roller bearings will be completely practical. It is also claimed to eliminate the hotbox problem. Positive seal at both ends of the housing is said to retain grease for long periods and block entry of foreign matter.

It is pressed on the car journal as a unit and is said to need no adjustment at any time. Use of adapters make installation interchangeable on old or new freight cars of varying design.

The World's Leading Manufacturers of
FUEL INJECTION EQUIPMENT
for
Diesel
Engines

DEPOTS AND SERVICE AGENTS IN OVER 100 COUNTRIES

C.A.V.

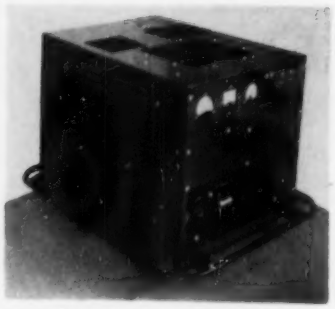
C.A.V. DIVISION OF LUCAS ELECTRICAL SERVICES INC., 653 TENTH AV., NEW YORK 36, N.Y.
Sales Office: 14820 DETROIT AVENUE, CLEVELAND 7, OHIO.

AP174-715.

new products

Battery Heater-Charger

To overcome the difficulties of operating lead-acid storage batteries at sub-zero temperatures, Fox Products Co. is making available Model 11, a unit originally developed for military use. It is claimed to be capable of being set to perform any one of three functions: maintain battery at desired temperature automatically and indefinitely; charge battery at pre-selected rate; or, simultaneously and automatically heat and charge battery at proper rate.



The charging process at low temperature levels becomes complex because of the semi-frozen condition of the electrolyte, causing internal pressures to build up if charging is attempted. Preheating is therefore made necessary. Previous heating devices, it is claimed, have not been very efficient. With external heating, difficulties are presented by the poor conductivity of the battery case wall. Built-in heating elements may be a partial solution, but so far efforts along this line have failed.

The new heater-charger uses the battery itself as the heat source. Alternating current is passed through the battery by attaching the heater directly to the battery terminals. Heat generated within the battery is thus said to be directly proportional to the AC resistance of the battery. Since internal resistance of the battery increases as it becomes cold, heating efficiency by this method is more efficient at low temperature. Polarizing effects are eliminated in AC operation.

The unit is designed for use with either 6- or 12-v batteries. Overall, it measures 27⅝-in wide, 23¼-in high, and 34½-in deep. Its case is equipped with both carrying handles and four casters. Power requirement is 60-cycle, single-phase 115/230 v. Maximum DC output for charging is 25 amp, and maximum AC output for heating is 500 amp for 6-v batteries and 325 amp for 12-v.

Inquiries regarding modifications of the basic model are welcomed. For example, the company states it also has available a self-maintainer which utilizes the battery's own power to maintain proper temperature for 48 hr while still leaving a 50% charge.

New Mack Truck Line

Now rolling off Mack Trucks' assembly line are work trucks which the company says are the most rugged of their size it has built. Designated B-80, they are designed specifically to meet the demands of heavy construction and other rigorous duty.

The new series consists of 11 models, with choice of diesel or gasoline engine, including the Thermodyne turbocharged diesel power unit.

At Last!

A PRACTICAL
ENGINE TEST
PACKAGE

Clayton
ENGINE DYNAMOMETER . . . complete with
ENGINE TEST STAND equipped with
UNIVERSAL MOUNTING ADAPTERS and
UNIVERSAL ENGINE COOLING SYSTEM

Clayton universal mounting adapters speed up diesel and gasoline engine test procedures. Engines of up to 1200 h.p. can be set up in a matter of minutes. Alignment is automatic. The Clayton Engine Test Stand, fitted with these adapters and the Clayton cooling system, and combined with the Clayton Series 17 Engine Dynamometer, provides a practical test facility for any engine rebuilding establishment.

MAIL COUPON FOR DETAILED INFORMATON

For specific information on the application of the Clayton Engine Test package to your particular operation, mail the coupon or write on your business stationery. Be sure to name the engine you service.

CLAYTON MANUFACTURING CO.
BOX 550, EL MONTE, CALIFORNIA
Name and type of engine serviced _____
Please send us complete details on use of Clayton Engine Test equipment and recommended requirements for testing engine named.
NAME _____
FIRM _____
ADDRESS _____
CITY _____ STATE _____

new products

Combustible Gas Indicator

Four models, each for a specific function, are introduced by Mine Safety Appliances Co. Instrument is housed in a case measuring 4-in by 5-in by 66-in and weighs only 6-lb.

Samples of atmosphere to be tested are drawn into the instrument by an aspirator bulb. Eight dry-cell batteries power a Wheatstone Bridge circuit. A calibrated meter shows the percentage of concentration.

Developed primarily for utility companies to test underground areas, the gas indicator is versatile enough to differentiate between natural gas and petroleum vapors. It could be useful in gas engine installations.

Micronic Full-Flow Filters

Newly engineered filter housings, Series QS, have been announced by Cuno Engineering Corp., designed specifically for high-capacity diesel full-flow lube systems. Features of this design are said to be easy maintenance, effective micronic filtration, high flow rates, and lower cartridge replacement cost.

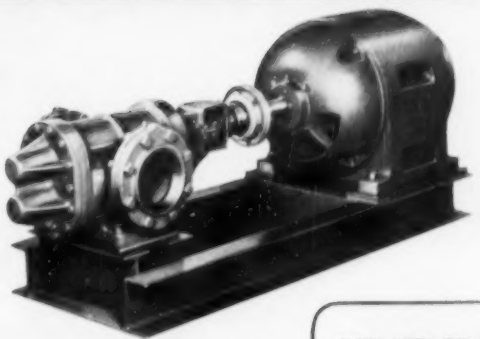
A special aspect is a quick-opening cover for fast and easy cartridge changes. One man, it is stated, can drop the swing bolts, lift the cover arm, swing the cover aside, and remove the cartridges in a matter of minutes. Cartridges used in the new housings are the Cuno Micro-Klean replaceable type. Degrees of filtration with these cartridges are 5, 10, 25, or 50 microns.

Flow rate for the largest of this QS series is 500 gpm at 150 SSU, 25-micron filtration, within a pressure drop of 2 psi. This unit measures 2½ ft across flanges and is 4½-ft high. The smallest unit is 2 ft by 2¼ ft and handles 80 gpm under the same conditions.

For greatest economy and filtration, the manufacturer recommends that the QS series filter be preceded by the new Cuno Super Auto-Klean on full-flow applications. On full-flow systems, all oil and both large and small contaminants pass through the fine passages of a replaceable cartridge. Since many of these particles exceed the design density of the cartridge, they cause reduction of cartridge life by plugging the pores. The Super Auto-Klean removes larger than 37-micron particles and is cleanable by simply turning a handle. When these larger particles are first removed, the replaceable cartridges are free to remove the fine particles for which they have been designed.

ROPER PUMPS

Complete Pumping Service for the Diesel Field



Series 3600 — 40 to 600 G.P.M. up to 60 P.S.I. Packed Box construction, hardened steel shafts, hardened alloy iron pumping gears. Heavy duty bronze bearings.

Series F — 1 to 300 G.P.M. up to 300 P.S.I. Packed Box or Mechanical Seal construction, hardened steel shafts, steel pumping gears, heavy duty flange type bronze bearings.

Series K — 1 to 50 G.P.M. up to 150 P.S.I. Packed Box or Mechanical Seal construction, hardened steel shafts, hardened steel pumping gears, heavy duty bronze bearings.

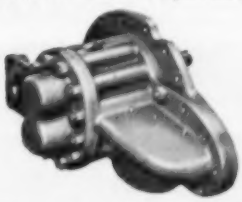
Custom — Adapting the Roper pumping principle to customer's requirements.

MAIN LUBE OIL PUMPS
Motor Driven
Engine Driven

STANDBY LUBE OIL
Before and After Pumps

FUEL SUPPLY PUMPS
Motor Driven
Engine Driven

AUXILIARY SERVICE PUMP
Fuel Transfer
Lube Oil Transfer
Hydraulic Power Control Pump



Write for catalog

ROPER *Rotary Pumps*

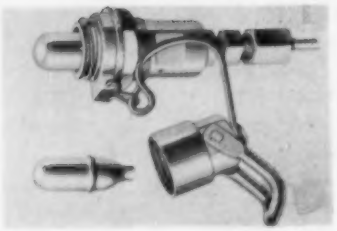
GEO. D. ROPER CORPORATION
164 Blackhawk Park Ave., Rockford, Ill.

new products

Ether Starting Aids

Caterpillar Tractor Co. announces that it has improved its direct electric starting systems. In conjunction with the glow plugs used in the company's 24-v systems, standard equipment now includes two ether starting aids and the necessary tubing to inject vaporized ether into the air intake manifold.

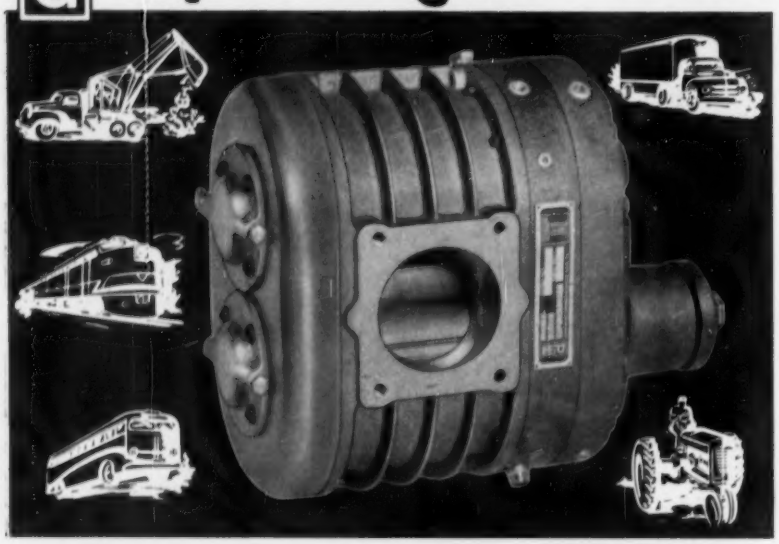
Use of the added equipment is claimed to insure easy and quick



starts in temperatures as low as —10°F. The systems are available as attachments for D6, D4, and D2 tractors and Nos. 933, 955, and 977 Traxcavators.

DIESEL ENGINES NEED

Supercharged Power



MIEHLE-DEXTER SUPER-CHARGERS

INCREASE HORSEPOWER, TORQUE, ACCELERATE YOUR ENGINES FASTER

Wherever Diesel engines work—buses, tractors, trucks—a Miehle-Dexter Supercharger adds a big boost to performance. Power is increased by the simple addition of this compact, space-saving supercharger. That means *extra* speed at any load, *extra* pushing or pulling power at any speed, wider speed range. More, it means faster acceleration with less smoke. Add all this to engines without increasing size, weight or cost. In fact, weight per horsepower is decreased. Standard M-D models available for most engine applications. For more facts, call or write Miehle-Dexter.

Soon available AN ENTIRELY NEW TYPE OF TURBOCHARGER

MIEHLE md DEXTER

Supercharger Division

Dexter Folder Company

113 Fourth St., Racine, Wisconsin

Self-Locking Set Screw

For soft metal applications, Set Screw & Mfg. Co. is introducing a headless, self-locking set screw under the name of Spred-Lok. In its manufacture, the top of the screw is spread slightly so that when it takes up the "flow" of the soft metal, a locking action is caused. No appreciable loss in locking efficiency is claimed in reuse.

When using the screw, a screw driver with parallel shanks is necessary so that engagement is made at the bottom of the slot. By moving the driver from side to side, the lock may be increased as desired. Test samples and technical data are offered by the company.

Multi-Service Grease

M. S. Grease, made specifically for automotive use, is being marketed by the Pure Oil Co. It is said to be the only lubricant needed to grease an entire fleet of trucks, cars, or construction equipment. Its use is also claimed to speed application, reduce lubrication errors, and lower costs.

Special features are complete resistance to water, high-impact resistance, rust protection, and high melting point. It can be pumped at low temperatures and is inhibited against oxidation. It's intended to replace conventional single-purpose greases used for chassis parts, wheel bearings, etc.

Redesigned Impact Wrench

Production of a new version of its ½-in square-drive universal electric impact wrench has been announced by Thor Power Tool Co. Called the No. 56 SpeedWrench, it replaces Model 55, and is designed for fast nut-setting and removal. With attachments, it can also be used for drilling; as a screwdriver; and for tapping, driving, or removing studs.

A finger-tip reverse button located in the handle allows "1-hand operation", one of its chief features. Internal modifications of the new model are claimed to add to the service life of operating parts, prompted by the needs of the automotive service industry. Forward and reverse speeds of 1900 rpm are developed.

new products

Automatic Hardness Tester

Now being displayed at the ASTE's Industrial Exposition in Chicago is what American Chain & Cable Co., Inc. states is the latest word in fully automatic hardness testing. The unit uses tiny photo transistors and intricate timing mechanisms to Rockwell-test the hardness of both ferrous and non-ferrous metals in hard or soft condition at the rate of up to 1000 pieces per hr. Operators of manual testers are said to generally average 200 to 400 pieces in the same time.

The parts to be tested are power-fed into the machine through a hopper arrangement and placed in position beneath a diamond penetrator. Testing loads force the diamond into the part; the resulting hardness determination, while it can be read on a dial, used to sort the part according to desired limits. The machine can be set to control limits as close as two Rockwell points and in addition, regulate itself to automatically test varying diameters and thicknesses.

Push-On and 2-Bolt Clamps

Two new fittings, a push-on for low-pressure use and a 2-bolt clamp for high-pressure use, have been developed by Flex-O-Tube Div., Meridan Corp.

The push-on is brass, comes up to ½-in size, and may be employed for pressures up to 250 psi. It may be assembled dry or with water as a lubricant by pushing the hose over twin ferrules on the fitting stem. A key feature is its speed of hose replacement; fitting may be left on machine and new hose installed by pushing it into place.

The clamp fitting, made of heavy malleable iron, is reusable and also features swift hose replacement by being capable of having new hose inserted over its stem while on machine. It is engineered for heavy construction equipment, farm tractors, oil well machinery, and for general heavy-duty plant maintenance.

Abrasive Cleaning Tool

Claimed to be the first completely self-contained abrasive cleaning tool is the Educt-O-Matic, a product of Clementina Ltd. It is a lightweight (11 lb) instrument operating on 33- to 60-cfm air supply. Connection is by a single ½-in air line.

The instrument, about the size of a small vacuum cleaner, is so designed that it carries both abrasive and dust into its body, the abrasive returning to the feed hopper and the dust going to a dust bag. Safety is provided by an automatic control on the operating lever which stops the unit if the operator's grip slips.

Up where the boiling point is low...

...Vernatherm® controls assure correct operating temperature for these BIG Diesel Machines

Here is your answer to tough coolant problems on Diesel and heavy-duty gasoline engines . . . Detroit Controls Vernatherm . . . a solid-charged thermostat that will take all the punishment big engines and rough duty can give it, and still give positive, precise coolant control *indefinitely.*

Pioneered by the Detroit Controls Corporation, these Vernatherm thermostats have a reputation for solving knotty problems in the roughest kinds of service.

Call on a Detroit sales engineer for application assistance . . . or write for Bulletin 213, which gives basic data on Vernatherm Controls and their function in modern engine design.

YOU LIVE BETTER WITH DETROIT CONTROLS

DETROIT CONTROLS CORPORATION
8900 Trumbull Ave., Detroit 8, Mich.
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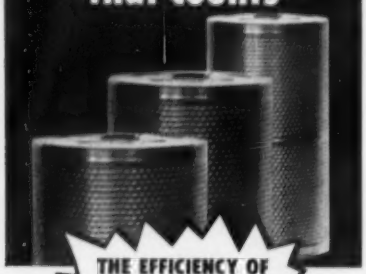
AUTOMATIC CONTROLS for
REFRIGERATION • AIR CONDITIONING • DOMESTIC HEATING • AVIATION • TRANSPORTATION • HOME APPLIANCES • INDUSTRIAL USES

it's what's **inside** that counts



THE EFFICIENCY OF

Luber-finer

PATENTED PROCESS

PACK

HAS NEVER BEEN EQUALLED

STANDARD of the INDUSTRY SINCE 1936

DON'T BE MISLED BY PRICE ALONE!

There is no substitute for DIESELPAK'S Patented Filtering Process for H.D. Compounded oils AT ANY PRICE. The DIESELPAK cleans more oil faster—keeps it CLEAN longer—and gives more service and better engineered protection than any other filtering element. It PAYS to get the BEST!

√ Protects engine

The DIESELPAK is designed to remove not only ABRASIVES but also CONTAMINANTS such as moisture, carbon, acid, etc., from oil, and is engineered to keep the **filtering media** and the **removed contaminants** from migrating back into engine.

√ Extends periods between drains

The DIESELPAK collects and holds even the most finely dispersed contaminants without affecting or removing compound additives from the oil. A glance at the dip stick will show that the oil is CLEANER —symbol of better lubrication and longer oil life enjoyed only by Luber-finer users.

√ Takes less oil

The DIESELPAK because of its engineered construction requires 2 to 4 quarts less oil than spongy substitute filter elements being offered for use in the Luber-finer housing. This is an additional saving enjoyed when using the DIESELPAK.

LUBER-FINER PACKS AVAILABLE:

1. *REFINING PACK*—Introduced to the public in 1935 for use with straight mineral oils, fuel oils, hydraulic oils, and inhibited industrial oils.

2. *DIESELPAK*—First made available in 1941, the DIESELPAK was primarily designed for use with H. D. detergent compounded oils and has also achieved outstanding results when used with fuel oils and straight mineral oils.

Write for complete information to Dept. 74

LUBER-FINER, INC.
2514 S. Grand Ave., Los Angeles 7

new literature

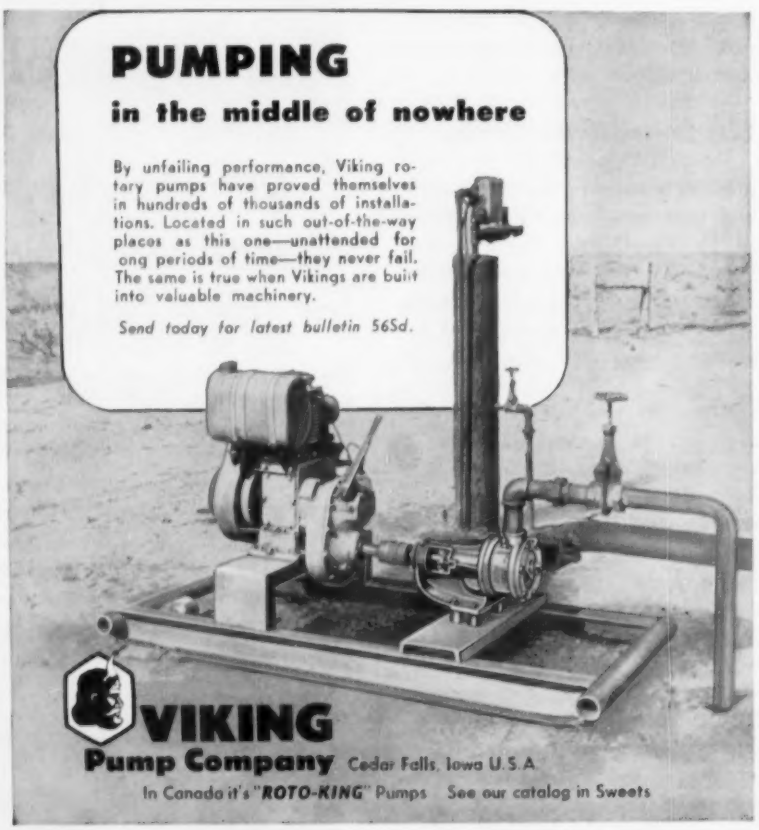
Power Transmission and Control in a self-contained unit for oil rig application is the function of the Type VS, Class 2F Gyrol Fluid Drive, detailed in a bulletin from American Blower Corp. Designed specifically for diesel engines, the new unit is given full feature discussion accompanied by operating explanations, installation photos, specifications, and a special table of oil cooler selection recommendations.

Electrical Maintenance Men are invited by National Carbon Co. to write for an 8-page booklet featuring its new general purpose industrial motor and generator brush, recommended where heavy load swings require exceptional brush characteristics. In-service reports define its record on a variety of applications and a graph compares its commutating ability and life with competitive types.

Multiple V-Belt Drive origin, development and types are detailed in a 36-page pocket size booklet released by Allis-Chalmers Mfg. Co. The evolution of standards in engineering these drives is covered and procedure for engineering a V-belt drive is supplied.

Hardness Conversion Tables for steels have been printed on a pocket-size celluloid card by International Nickel. Taken from the SAE handbook, the tables give approximate relationship between Brinell, DPH (Vickers), Rockwell, and Shore Scleroscope hardness values, and corresponding tensile strengths of steels.

Flexible Metal Hose Products of every type manufactured by Flexonics Corp., are fully detailed and illustrated in a 12-page catalog, each shown in typical application photos. Complete coupling data is included as well as an easy 4-step metal hose selection guide.


PUMPING
in the middle of nowhere
By unfailing performance, Viking rotary pumps have proved themselves in hundreds of thousands of installations. Located in such out-of-the-way places as this one—unattended for ong periods of time—they never fail. The same is true when Vikings are built into valuable machinery.
Send today for latest bulletin 56Sd.
VIKING
Pump Company Cedar Falls, Iowa U.S.A.
In Canada it's "ROTO-KING" Pumps See our catalog in Sweets

new literature

New Steel Foundry Directory
published biannually by the Steel Founders' Soc. of America, is now available at $10 per copy. Every known foundry in the U. S., Canada, and Mexico is included along with basic information on type of steel castings produced, processes used, and general plant information.

Special Chemical Sealants
for multiple industrial applications are explained in a reference guide and chart issued by Permatex Co., Inc. Failure to use proper sealants to prevent leakage and seepage, the company declares, costs industry more than $1 billion a year.

Flexible Nylon Tubing
is the subject of the latest bulletin of The Polymer Corp. of Pennsylvania. Air, process, coolant, fuel, oil, lubricant, and hydraulic lines include the uses described.

Pipe Fittings and Flanges
made of unplasticized polyvinyl chloride (PVC), are treated in a data booklet from Tube Turn Plastics, Inc. Along with industrial applications, it gives complete specifications for threaded and socket types, installation information, pressure - temperature charts, and chemical resistance tables.

Need for Better Roads
is pointed out by General Motors Corp. In a service film, "Give Yourself the Green Light", running 26 min. in sound and color. Prints are available free of charge.

Aluminum Users
will be interested in a brochure from Peter A. Frasse & Co. which explains the general properties, fabricating characteristics, typical applications, and available size ranges of commercial aluminum alloys. Also included are alloy designation, weight comparison, and temper designation charts.

BIG SHIPS — BIG RESPONSIBILITIES — *they can't afford to feed their Diesels* — A MICKEY FINN!

THE BRIGGS-EQUIPPED USS FORRESTAL

photo courtesy U. S. Dept. of Defense

SMART ENGINEERS KNOW that abrasion is a deadly knock-out drop to ANY Diesel. For long sea duty . . . . for constant peak performance there IS a reason for using Briggs on so many BIG jobs where dependability counts.

MARINE DATA SHEETS FOR ALL TYPES OF DIESELS, LARGE OR SMALL. WRITE FOR YOURS NOW. USE THE COUPON.

Briggs
PIONEERS IN MODERN OIL FILTRATION

OIL FILTERS

THE BRIGGS FILTRATION COMPANY, DEPT. 99
WASHINGTON 16, D. C.

YES! Send me all of your Marine Data sheets.

Name _____

Company _____

Address _____

Your Guide To Diesel MAINTENANCE CLEANING

Here—in this new Power Plant Cleaning Guide—you will find one money-saving suggestion after another to help speed up your diesel overhauling and reconditioning work. Here, for example, are described the most modern, most effective procedures for:

- **Soaking hard carbon deposits off aluminum pistons**
- **Removing rust and scale from diesel cooling system**
- **Cleaning filters**
- **Desludging lube oil coolers**
- **Degreasing parts before repair**
- **Steam-detergent cleaning**
- **Stripping paint**

And saving time and money on many other important maintenance operations.

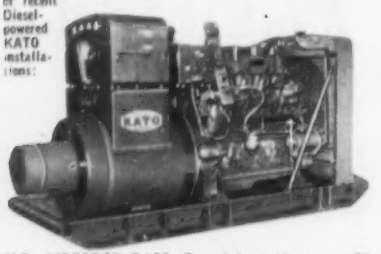
A FREE copy of this informative booklet will be mailed promptly on request. No obligation. Write Oakite Products, Inc., 22C Rector Street, New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE

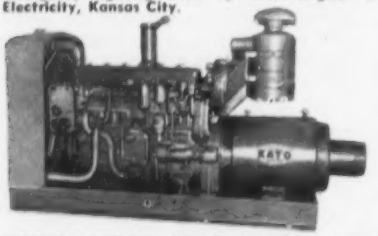
Technical Service Representatives in Principal Cities of U. S. and Canada

KATO
CONTINUOUS A.C. AND STANDBY
GENERATORS
ARE ADAPTABLE TO ALL MAKES OF ENGINES...
SIZES TO FIT ANY NEED UP TO 500KVA

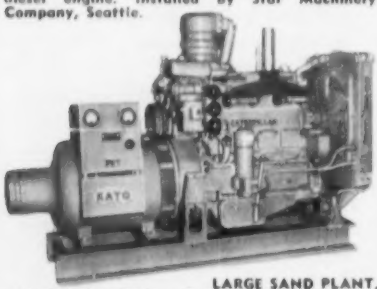
Three illustrations of recent Diesel-powered KATO installations:



U.S. AIRFORCE BASE, Grandview, Mo. uses 75-KW, 93.8 KVA, 120/240V., 60 cycle, single phase, 1800 RPM KATO Generator, driven by P & H Harnischfeger Model 487-18 diesel engine, for emergency lighting. Sold by AAA Engine & Electricity, Kansas City.



BOEING AIRPLANE CO., Seattle, Wash., purchased 175 KW, 219 KVA, 3 phase, 3 wire, 60 cycle, 1800 RPM, revolving field type KATO Generator, General Motors Model 62403-RA diesel engine. Installed by Star Machinery Company, Seattle.



LARGE SAND PLANT, operated by Barton Const. Co., uses Model 8SEPS4, 150 KW, 187 KVA, 220/440V., 3 phase, 60 cycle, 1800 RPM, 2 bearing, close coupled type KATO Generator adapted to No. 0 bell-housing on Caterpillar D337 diesel engine. Sold by Wm. H. Ziegler Co., Minneapolis.

WRITE

Builders of Fine Electrical Machinery Since 1928

KATO Engineering Company

1408 First Avenue, Mankato, Minnesota

new literature

Revised Engineering Standards

for multiple V-belt drives have been jointly issued by Multiple V-Belt Drive & Mech. Power Trans. Assn. and Rubber Mfrs. Assn., Inc. Proper sheaves and belts to be used for optimum efficiency are indicated. Basic changes include 10 pages of new horsepower ratings.

Precision Speed Control

with its new Ampli-Speed magnetic drive is detailed by Electric Machinery Mfg. Co. in a new folder. It explains use for both fan-type and constant torque loads and specifies horsepower ratings, speed ranges and dimensions.

Fire and Accident Control

codes, standards, and references have been indexed by Loss Control Associates as a new information service. It provides exact directions on where to find complete information on any phase of control and also offers a directory of publications.

Industrial Truck Costs

covering the two most important phases—cost of ownership and operation, is the subject of a brochure from Elwell-Parker Electric Co. A cost checklist is first offered and then information supplied on methods of reducing operating costs.

The Atom in Our Hands

a 44-page booklet, has just been published by Union Carbide and Carbon Corp. to describe the work being done at Oak Ridge. Harnessing of the atom to industry's use is one of the subjects covered.

Venturi Tubes and Nozzles

designed to meet such factors as temperature, line pressures, and type of fuel handled, are discussed in a documented bulletin prepared by Simplex Valve & Meter Co. Data on construction and installation, range of sizes, and specifications are given.

What Do You Know!

(*Answers to Questions on Page 55*)

1. Correct answer is "a". It has been proven that even dirt particles as small as 1 to 5 microns cause excessive cylinder wear, piston ring sticking, piston ring and groove wear, and lube oil contamination. See article on Page 93.

2. Correct answer is "b". Particles of 1 to 5 microns cause excessive wear during starting when there is no oil film between moving parts and when they accumulate, forming deposits. See article on Page 93.

3. Correct answer is "b". Tests made by engineers have shown that over 40% of deposits on the cylinder walls and piston grooves are dirt which gets through inefficient filters or damaged hoses, etc. See above article.

4. Correct answer is "a". Heat from combustion flame fuses silicate material into abrasive glass-like particles. See Page 93.

5. Correct answer is "a". Although test engines have been turbocharged to give 300% more power, the average commercial vehicular turbocharged engine gives 50% more power than a naturally aspirated one. See article on Page 88.

6. Correct answer is "c". Lag in time between when fuel is increased until turbocharger speed is increased, results in momentary lack of air. See article on Page 88.

7. Correct answer is "b". End-point is indicated as the maximum temperature reached in complete distillation of the fuel under ASTM procedures. This is a function of the fuel's volatility. See article on Page 96.

8. Correct answer is "b". Cetane index is a measure of a fuel's ignitionability. In general, as the fuel's cetane index increases, horsepower to be expected decreases. See article on Page 96.

How much of your engine maintenance bill is due to repair of breakdowns that could have been avoided—*if you'd had advance warning?*

At a fraction of that cost, Alnor Exhaust Pyrometers offer you a constant check of engine performance—advance warning of

Cylinder Overload **Preignition**
Scaled Jackets **Clogged Ports**
Detonation **Faulty Injection**

Get the best from your diesel—minimum fuel consumption per horsepower and long service uninterrupted by foreseeable breakdowns. Get constant protection of your engine, cylinder by cylinder, with an Alnor engineered Exhaust Pyrometer System.

Get Full information—Quickly! Your nearby Alnor Diesel specialist is conveniently listed in the classified directory. Ask him to help you select the Pyrometer and thermocouple assembly designed for your engine. Or send for Bulletin 4361 with complete details of the full Alnor line of Pyrometers.

ILLINOIS TESTING LABORATORIES, INC.
Room 507, 420 N. La Salle St., Chicago 10, Illinois

new literature

Fuel Ignition Properties in relation to fuel composition are examined in a 4-vol report of the U.S. Commerce Dept.'s Office of Technical Services. Numerous methods of evaluating ignition behavior were tested and charts, tables, and ignition diagrams cover the findings. Purpose of the studies was to investigate the possibility of bolstering the supply of high cetane straight-run fuel by use of low-cetane fuel.

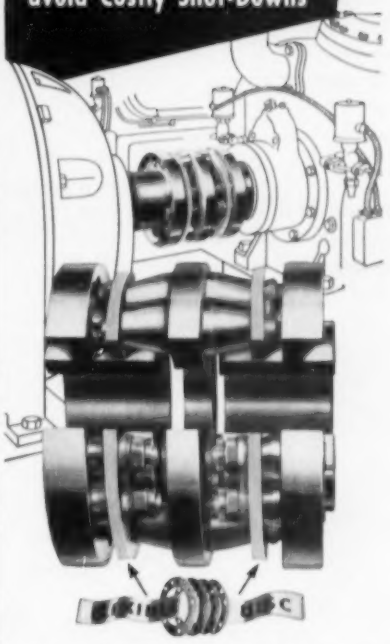
Allis-Chalmers' New HD-6 diesel-powered crawler tractor with 45 drawbar hp has been fully detailed in a two-color catalog. Engineering, design, and performance features are explained with the help of illustrations, which are also used to review the new engine and its matched accessories.

Heat Transfer Apparatus of various types, built in simple units from which enitre cooling and condensing systems can be constructed, are described in literature available from National-U. S. Radiator Corp. The 24-page catalog was prepared as a comprehensive reference guide and includes hints on installation.

Vacuum and Liquid Pumps air brake equipment, and hydraulic motors, controls, and pumps are detailed in a general product brochure offered by the New York Air Brake Co. It's intended to serve as a quick guide to equipment produced by the company's five manufacturing divisions.

Radio Communication System registries listing name and address of each licensee, location of fixed stations, number of mobile units, call letters, and operating frequencies are being published by Communication Engineering Book Co. First of the new series is for industrial systems, which include power utilities, petroleum and gas, and VHF maritime communications.

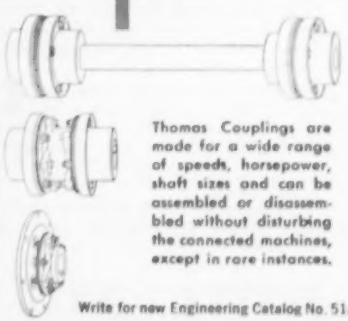
Specify **THOMAS** ALL METAL
FLEXIBLE COUPLINGS
for Power Transmission to avoid Costly Shut-Downs



Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.

DISTINCTIVE ADVANTAGES

FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Thomas Couplings are made for a wide range of speeds, horsepower, shaft sizes and can be assembled or disassembled without disturbing the connected machines, except in rare instances.

Write for new Engineering Catalog No. 51A

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

new literature

The Metal of Tomorrow
titanium, is given up-to-date treatment in an illustrated booklet published by E. I. du Pont de Nemours & Co., Inc. Properties and methods of fabrication are discussed along with present ranges of commercial application.

Metal-to-Metal Adhesives
compounded commercially, have been evaluated in a series of tests to determine the best for long-time, high-temperature bonding. The complete report of this research for the Air Force has just been released to industry through the OTS, U. S. Dept. of Commerce. Primers, fillers, and methods of preparing various metal surfaces for bonding were also included in the study.

Properties of Cork
both natural and composition, are discussed by Dodge Cork Co., Inc. in Bulletin S-56. Various applications considered include inserts for clutch and brake facings, fuel system floats, gaskets and seals, and vibration isolators.

Danger in the Heat Zone
is the title of a booklet from Caterpillar Tractor Co., which discusses how heat prostration in vital parts of diesel engines can be avoided through sound metallurgy and careful machining.

Asbestos Safety Clothing
a 12-page booklet, has been issued by Johns-Manville, detailing various articles of safety apparel which are treated to resist heat, oil, water, and abrasion. Long-haul truckers will be interested in a fire-smothering blanket, also described.

news of our industry

Air-Cooled Diesel Announced by Fermont

International Fermont Machinery Co., Inc., of Ramapo, N. Y., announces a new light-weight, air-cooled diesel engine with an entirely new combustion chamber principle. Designed to produce over 10 hp per cylinder with a compression ratio of 13:1; present plans are to produce single-, 2-, and 3-cyl engines.

Present models are designed for military use and for application to end products, such as marine equipment, pump units, tractors, compressors, welders, etc. Mr. Fred Graves, designer of the engine, is in charge of this engine division.

Fermont manufacturers a complete line of electric plants from 1 kw-250 kw for military, industrial, commercial, and consumer applications.

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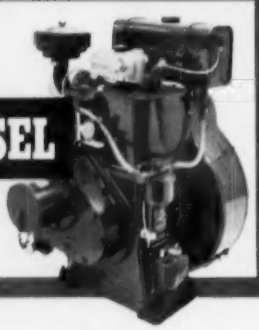
PETTER DIESEL
family yet?



In the rugged PETTER diesel family are aircooled and water-cooled models all the way from 1½ hp (the toughest baby yet) to 48 hp. And long, faithful service is an old Petter family tradition; witness the more than 400,000 Petters in use throughout the world.

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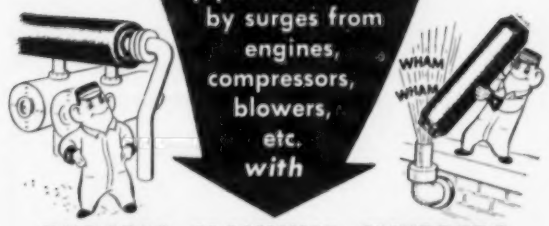

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These controls can be used with Diesel, Gasoline, and Gas engines.

Request Bulletin 501

Synchro-Start Products Inc.

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news of our industry

Railroad Material Testing

With increased speed of operations placing greater stresses on all the materials they use, railroads have developed four principal methods of locating hidden flaws in these materials as a necessary safety factor.

These non-destructive testing methods (which leave the object still usable after test) are electro-magnetism, supersonics, black light, and atomic radiation. Parts tested include rails, car and locomotive axles, couplers, truck side frames, and such diesel engine parts as valves, pistons, and cylinder heads.

Electro-magnetism principles are employed in detector cars to find internal defects in rails. This is done by passing an electric current through the rail, setting up a magnetic field. Defects cause distortions in this magnetic field. The detector cars record them and automatically mark each spot for later removal.

Supersonics, or silent sound, is also used to find rail flaws in areas adjacent to the ends or joints. In this method a beam of pulsed, high-frequency vibrations is passed through the rail. The time it takes to bounce back off the far side and return is registered, and any variation indicates a fault. The test is made either by a special car or by a 2-man team on foot using portable equipment.

Black light involves the use of rays outside the visible portion of the spectrum. After the part being tested has been coated with a mixture of ferro-magnetic particles suspended in oil, the part is magnetized and black light applied. The magnetic particles are drawn to any crack or flaw, and glow under this light to indicate the pattern of the defect. This method can also be used with dry particles.

A variation of the black light process does not involve the use of magnetism. Instead, a non-metallic fluor-liquid penetrant is applied to the part and after it soaks in, is wiped off. The black light shows up penetrated cracks.

It was also recently discovered that black light is useful in detecting small leaks in diesel fuel lines. Since lube oil and fuel oil have different colors under this light, a fault in the fuel line may be simply traced to its source.

The latest testing method uses radioactive cobalt, called cobalt 60, obtained from the Atomic Energy Commission. X-ray films are taped to the back of parts to be tested, which parts are exposed to the cobalt. The exposure outlines defects clearly on the film. Precautions are necessary, however, for operator safety.

Noise Abatement Conference

A record turnout is expected for this year's National Noise Abatement Symposium, devoted to discussion of noise problems and acoustical developments. To accommodate the attendance increase, this seventh annual event will be held at the Hotel Sherman in Chicago instead of the campus of Illinois Institute of Technology, site of previous meetings. Dates are Oct. 11 and 12.

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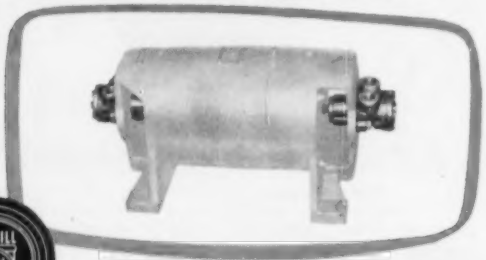

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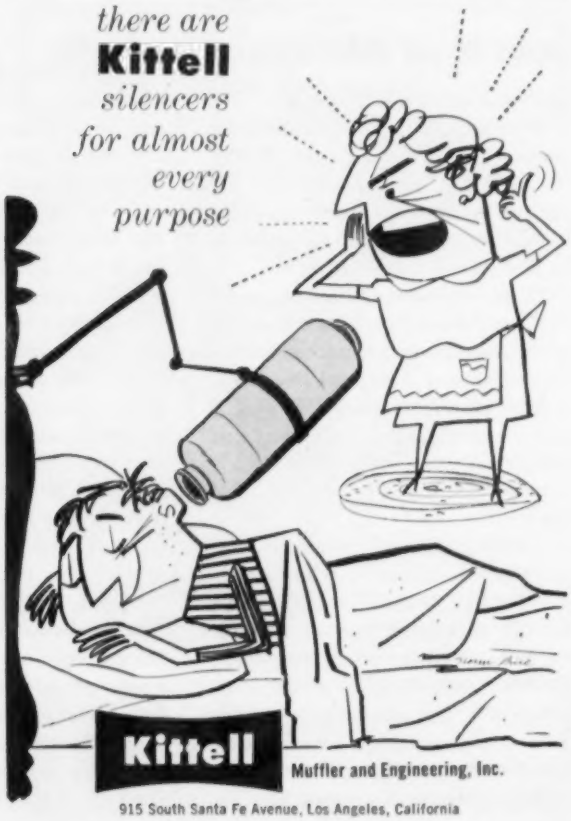

Kittell Muffler and Engineering, Inc.
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news of our industry

Battery Charging Warning

As a service to the industry, F. S. Stead, service manager of the Electric Auto-Lite Co., advises on the charging of 12-v batteries. The use of special equipment, he states, depends on whether fast charge or slow charge is desired.

Ordinary slow chargers, he says, are suitable for charging both 6- and 12-v batteries on the same circuit. But each 12-v battery must be considered equal to two 6-v batteries and the charging rate adjusted to suit the smallest 12-v battery on the line.

With fast chargers, however, it is a different story. Serious consequences can result from using a 6-v fast charger on three cells of a 12-v battery. Only 12-v fast chargers should be used on 12-v batteries, he warns. And always follow the instructions of the manufacturer of the charger for control and test procedures, he adds.

Set Retreading Standards

Retreaded tire users will now be assured quality workmanship and materials under standards established by a newly formed Tire Retreading Institute. Subscribers to the TRI Code of Ethics will receive a seal of approval for every tire they retread for truck or car owners.

The TRI seal will show that the tire has been carefully inspected, that best grade materials were used, that the job was done by trained workers, and that the tire is guaranteed.

The new association is an affiliate of the National Tire Dealers and Retreaders Assn., and was established at a recent convention in New York as a means of improving customer acceptance of retreads. An independent research organization will be established to assure that shops maintain standards at all times.

Cat Opens New Plant

May 21 is the official date set by Caterpillar Tractor Co. for the opening of its new wheel tractor and motor grader manufacturing plant at Decatur, Ill. Some 35,000 visitors are expected to tour the grounds during a 5-day open house extending through May 25.

The new plant was built to free the company's Peoria, Ill. facilities for full production of diesel engines and crawler tractors. It is the fifth new plant in the firm's post-war expansion.

Speaks on Air-Cooled Diesel

Dr. Richard Kloss, director of research, Kloeckner - Humboldt - Deutz, Ag, German diesel firm, recently lectured before a select audience of high Canadian government and military officials. In his speech, he pointed out the advantages of air-cooled diesels which his company has been exporting to Canada and the U. S. He declared that air-cooling calls for much less delicate parts than water-cooled engines and are particularly suitable for transportation, stationary, and military vehicle usage.

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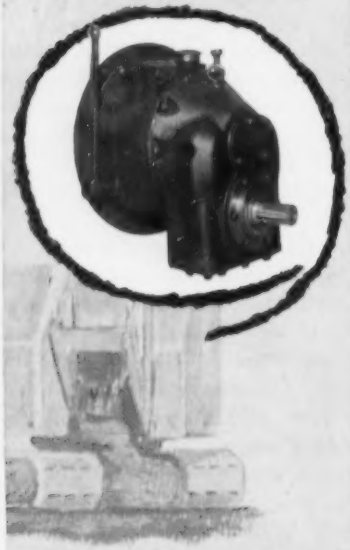

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news of our industry

Regrinding Camshafts

Overhead valves type gasoline engines was the answer of designers to demands of the automobile industry for more compact, higher output, more durable and more economical operating engines. Ohv permit higher compression ratios with all their well known advantages. This has been proven by the tremendous success of 4-cycle diesel engines which get high compression ratios only through the use of ohv.

The change from L-head design to ohv in gasoline engines resulted in new problems. While the majority of "bugs" were ironed out, camshaft and tappet wear are still somewhat of a problem. Complaints from the field of increased camshaft lobe and valve tappet wear is so widespread that the SAE is devoting much time on discussion, research, etc. on this subject. However no cure-all has yet been found.

Heavier valve springs are necessary on ohv engines for various reasons. These plus higher lift cams result in a hard impact each time the cam raises the valve lifter. Also a lubrication problem exists at this sensitive wear spot. These and other complications make late design gasoline engines more critical to cam lobe and tappet wear and failure than the L-head type. And this to a certain extent also applies to diesel engines.

To achieve maximum power output fuel economy, quiet operation, smooth idling and easy starting, valve action must be precise. The usual practice has been to discard worn, chipped or twisted camshafts which didn't give the desired valve action. However, today the trend is toward servicing and reusing the camshafts in gasoline engines. And especially in diesel engines where the camshaft cost is higher.

During the past year, engine shops, builders, jobbers, machine shops, independent garages, dealers and fleets have bought a great deal of camshaft regrinding equipment. With this equipment old camshaft lobes are reground to incorporate the latest improvements present in the latest design engines. All who use them are more than satisfied with the results and the additional profits they're bringing in. But not nearly enough outfits have bought this type of equipment as yet. However many are rushing to capitalize on its use.

In the opinion of many engineers the day isn't too far off when camshaft regrinding will become as common and as profitable as crankshaft regrinding.

Diesel Competitor?

In a few years, a British scientist forecasts, because of the demand for fuel, a fuel cell now under development may be used for rail traction. In a report before the AIEE, A. M. Adams, English research scientist, described the cell as a high-pressure hydrogen/oxygen device. It was developed by F. T. Bacon, England, in response to current interest in promoting more efficient methods of generating electricity from fuels.

Mr. Adams stated that research at present is centered on the redox, hydrogen, and high-temperature gas cells, because it will be some time before nuclear energy can meet increased demand. Electrochemical cells operating on natural or processed fuels (fuel cells) are said to offer a possible alternative method of generation and might also be used for energy storage on a larger scale than is now economical with secondary batteries.

Further, he indicated, electrochemical cells might be used to convert heat from a nuclear reactor directly into electrical energy. As generators, therefore, such cells could replace the boiler, turbine, and alternator of a nuclear power station.

The application of Bacon's cell to rail traction would be much improved, he emphasized, if impure hydrogen and air could be used, or if the principles employed in the cell could be applied to improve the efficiency of electrolyzers. There is a possibility that fuel cells using solar energy may be developed, he declared, and that fuel cells could possibly compete with diesel generators in a mobile power plant.

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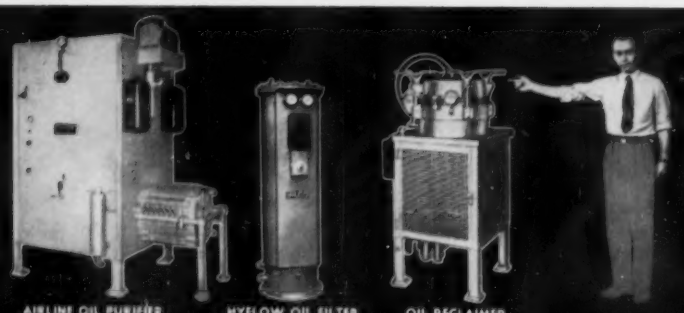
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organizational news

A. A. Batts, Jr.

Named Director of Advertising

and marketing research, Arthur A. Batts, Jr. got one of the two promotions at ALCO Products, Inc. A. Robert Jaeckel was made manager of advertising and sales promotion.

New Posts and a Navy Man

are the latest news from Alco. Dana T. Hughes, formerly director of information, is now occupying an office as director of public relations, with Roger C. Witherell, a recent addition to the company, taking over his spot as manager of the news bureau. The navy man, Capt. C. S. Seabring, has been appointed director of research and development, a position created by the company's enlarging activities in that field.

Assigned Additional Duties

at Elliott Co., John W. Anne, vice president in charge of headquarters application engineering, will now also be responsible for manufacturing operations for the Jeannette Div. of the company. He came to the company in 1925.

Research and Testing

will be the function of the Turbo-Dynamics Div., just launched by Joy Mfg. Co. at Buffalo. Its objective, production of advanced compressors, turbines, and other air and gas-handling devices as laboratory prototypes and the establishment of designs for regular manufacture. Heading the new laboratory is L. Roy Krouse under the top management direction of John D. Russell, vice president.

Air Filter Pioneer

W. M. Reed, founder and chairman of the American Air Filter Co., Inc., is dead of a heart attack. In December he had moved from the presidency of the company to the newly created post of board chairman. W. G. Frank, then executive vice president, succeeded him as president.

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organizational news

Two Management Changes

have occurred at J. A. Zurn Mfg. Co. Frank W. Zurn, who was sales manager for the mechanical power transmission products division, is now vice president-manufacturing. The other change was the naming of Paul I. Benton to plant manager of production and personnel relations.

West Coast Sales Managership

has been placed in the hands of David D. Gordon, by Fulton Sylphon Div., Robertshaw-Fulton Controls Co. W. J. Hajek, former manager of the Los Angeles office, has been transferred to Chicago. Mr. Gordon's territory covers California, Washington, and Oregon.

Taking Over as Chief Engineer

at Minnesota Rubber and Gasket Co., Robert R. Johnson will be in charge of all engineering operations that go into the concern's manufacture of molded rubber products and seals. Previous to this appointment, Mr. Johnson was general manager of Master Tools, Inc., a subsidiary firm.

Named District Manager

of Link-Belt Co.'s New Shreveport, La. office is Gerald Stone, who formerly was located in Texas. This brings to 40 the network of Link-Belt district offices in key cities from coast to coast.

Elected President

of the Tyson Bearing Corp., a subsidiary of SKF Industries, Inc., A. S. Murray takes over from H. I. Lewis who resigned. Mr. Murray used to be assistant to the president of SKF. E. R. Broden who has been elected chairman of the Board of Tyson and a director.

A. S. Murray

Heating and Cooling Activities

will be the province of L. H. Kramer, just appointed general manager of that division of Union Asbestos & Rubber Co. Prior to his new assignment, Mr. Kramer was executive vice president and general manager of American Well Works.

J. H. Newton

White Diesel Engine Div.

of White Motor Co. has a new sales manager. He is J. H. Newton associated with the company since 1948.

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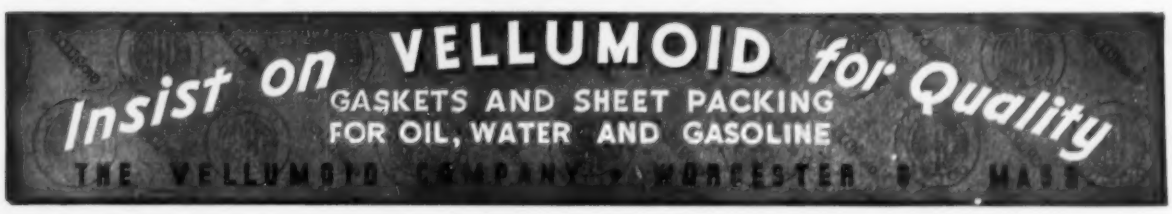
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organizational news

Three Engineer Promotions
have occurred at Bendix-Westinghouse Automotive Air Brake Co. A newly created post, director of research, has been given to Ellery R. Fitch. His former duties as director of engineering are now the province of Stephen Johnson, Jr. Bringing up the line is R. Van Dyke Firth, who has been advanced to Mr. Johnson's former office as chief engineer. He was lastly executive engineer.

Inventor of the Timing Belt,
a rubber and fabric belt with teeth, R. Y. Case received a scroll and the Edward Longstreth Medal from S. Y. Rolph, left, president of the Franklin Institute. Mr. Case, chief engineer of the Power Transmission Dept. of the U. S. Rubber Co. patented the belt in 1950.

New Advertising Manager
for both the Industrial and Precision Divisions of Foote Bros. Gear and Machine Corp., Theodore C. Beug was formerly advertising manager and sales promotion manager in the heavy equipment industry.

T. C. Beug

Assuming Other Duties
at SKF Industries, Inc., William A. Sine, Jr., is now general supervisor of production material control and procurement. He had been a member of the purchasing staff, previously.

W. F. Rowley

New Purchasing Agent
for the Construction Machinery Div. of Clark Equipment Co., is W. F. Rowley. He has been assistant purchasing agent of Clark's Automotive and Industrial Truck Div. for 13 years.

OPPORTUNITY
Well established Diesel Engine business for sale, due to ill health. Apply to Box #4-22, Diesel Publications, Inc., 192 Lexington, Ave., New York 16, N. Y.

The law of averages says that cancer will kill one out of every six Americans. But the law does not have to prevail. You can help break it in two ways. By having a thorough medical checkup every year . . . and by sending a contribution to your Unit of the American Cancer Society or to Cancer, c/o your town's Postmaster.
Fight cancer with a checkup and a check.
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Parts and Service
Models—B-BP-PBM, A-PA-PAM, C-PCM-PC, V-VM, V-8
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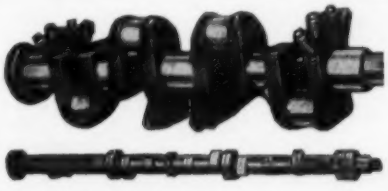
406 Olds Avenue Lansing, Michigan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since he switched to GM Detroit Diesel Power

"Fastest working shovel I've ever seen," says the owner of this new GM Detroit Diesel-powered Bucyrus-Erie 71-B. "We had considered another make of engine, but when I went to the factory and saw how fast this machine worked with a GM "110" engine, we switched the order to GM Diesel. This new 3 yard unit loads 4000 yards in 8 hours on about 8 gallons of fuel per hour. Maintenance cost to date is practically nil."

Maximum production at minimum cost—that's what you get when you buy General Motors Detroit Diesel engines. They power more than 1,000 different applications in machinery for every type of work. When you order equipment, be sure to specify GM Diesel power. It's America's FIRST CHOICE Diesel *because it does more work at less cost!*

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Single Engines . . . 30 to 300 H.P. *Multiple Units . . . Up to 895 H.P.*

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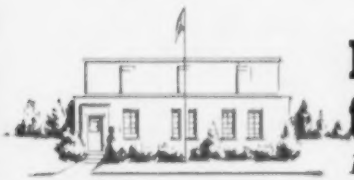
Melvin Nissen (left) plant superintendent Graettinger, Iowa, and Standard Oil lubrication specialist R. R. Spargo inspect maintenance records. Assisting customers with lubrication problems is something for which Bob Spargo is well qualified. He is a mechanical engineer with a degree from Iowa State College and a graduate of the Standard Oil Sales Engineering School. Bob has been providing lubrication technical assistance to Standard customers for nearly nine years. Customers find his experience and training pay off for them.



How STANDARD D&G Oil helped lick five problems in one plant

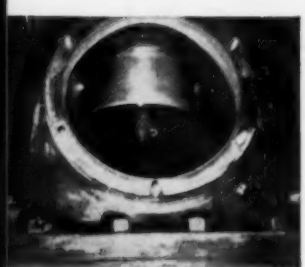
Excessive deposits, excessive maintenance, high oil consumption, were among problems solved by change-over to STANDARD D&G Oil at Graettinger, Iowa, Municipal Light Plant

Three years ago the Graettinger Municipal Light Plant began using STANDARD D&G Oil. Prior to this change-over, good engine performance was hampered by:

1. **Excessive carbon deposits**
2. **Excessive port carbon**
3. **Stack fires**
4. **Ring sticking**
5. **High oil consumption**

The plant averages 4.3 million HP hours of operation annually. Before changing to STANDARD D&G Oil, ports had to be cleaned several times a year. Now, with STANDARD D&G Oil in the engines, ports aren't touched between annual overhauls. Ring sticking and piston and cylinder deposits are virtually eliminated. All of this has been accomplished while continuing the use of low cetane, low gravity fuel.

Good management, careful maintenance and STANDARD D&G Oil have teamed to deliver this performance at Graettinger. Maybe you would like to use STANDARD D&G Oil to obtain similar performance from your engines. A Standard Oil lubrication specialist is nearby in any of the 15 Midwest and Rocky Mountain states ready to show you. Call him. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.



Piston of one of F-M engines at Graettinger Light Plant. STANDARD D&G Oil has kept maintenance down, cut piston and liner wear.

Standard man Bob Spargo (left) and plant superintendent Melvin Nissen inspect piston through crankcase inspection plate hole. With STANDARD D&G Oil, light plant has cut oil consumption in half.

***Quick facts about* STANDARD D&G OIL**

1	Made from highest-quality solvent-refined stock.
2	Contains additives which impart superior detergent-dispersant and anti-corrosion properties.
3	Anti-foaming.
4	Oxidation resistant.
5	Recommended for use (1) with economy fuels, (2) in extreme-load and/or low temperature service.

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